INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
1. A wireless network, comprising:	Each combination having at least one item listed on Exhibit A, at least one item listed on Exhibit B, and at least one item listed on Exhibit C is a wireless network or a system (hereafter "Accused System"). Because infringement liability is not dependent on ownership, e.g., use of a system can infringe (35 U.S.C. § 271), infringement is not dependent on ownership of all limitations of a claim. A wireless network comprises at least: (1) Radio Access Network comprising at least one base station controller, at least one transceiver, and at least one antenna; (2) a system of computers, the system of computers comprising computers associated with the at least one base station controller(s); computers functioning for network optimization, including at least computers implementing D-SON and C-SON; and, computers functioning for locating wireless devices; and, (3) one or more wireless devices.[1] There is no requirement that each computer of the system of computers locates a UE.
at least two wireless devices each communicating via radio frequency signals;	Plaintiff contends each item listed on Exhibit A corresponds to this claim limitation because each Exhibit-A item is a base station having a RF transceiver whose parameters have been configured for RF communication with mobile wireless communications devices (specifically two or more of the mobile wireless communications devices identified on Exhibit B). The following exemplifies this limitation's existence in Accused Systems:

[1] A wireless device is considered within the wireless network when in RF communication. However, a processor of such wireless device may also be considered outside or inside the network.

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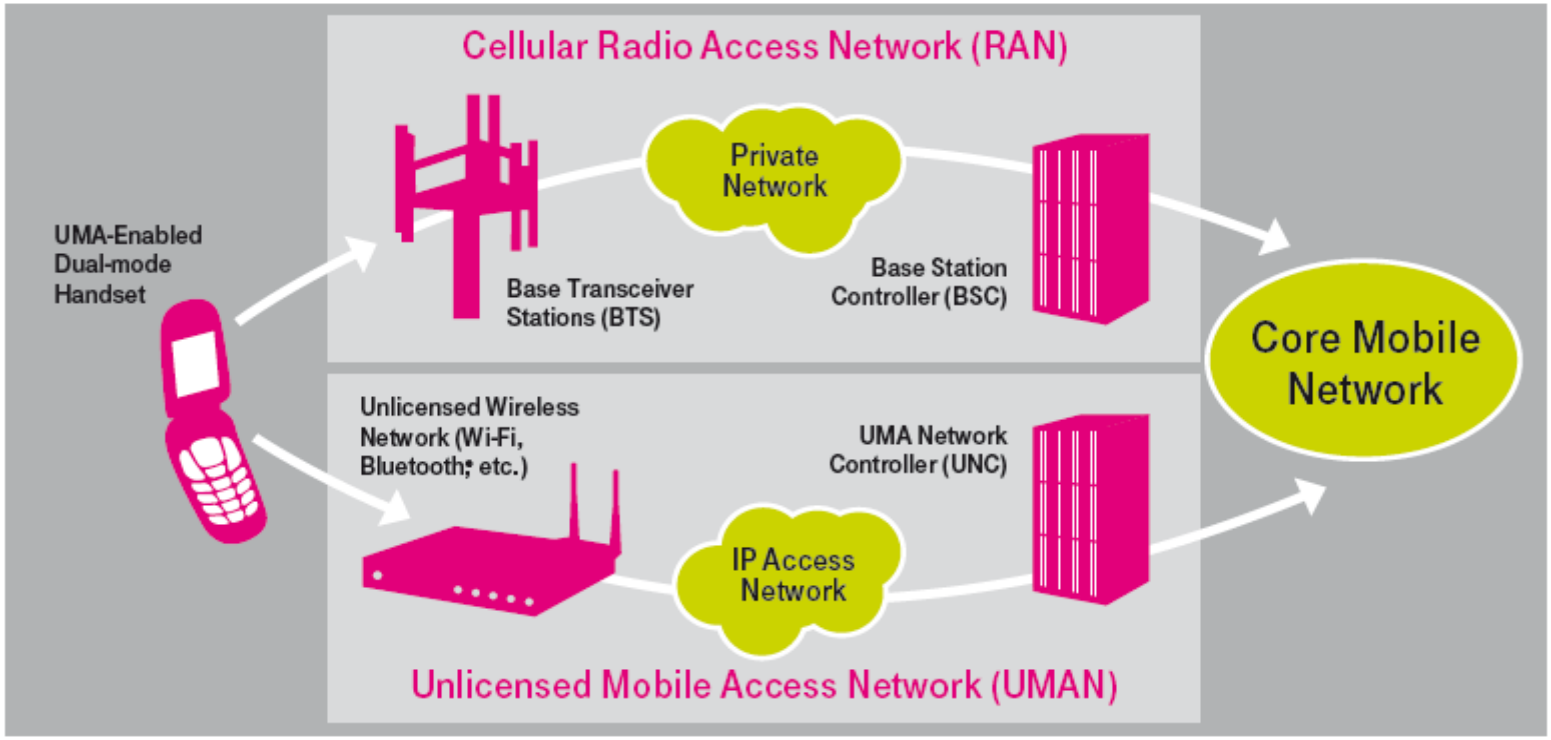
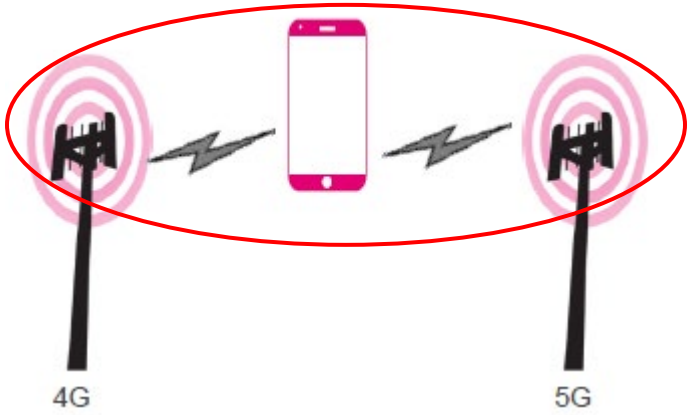
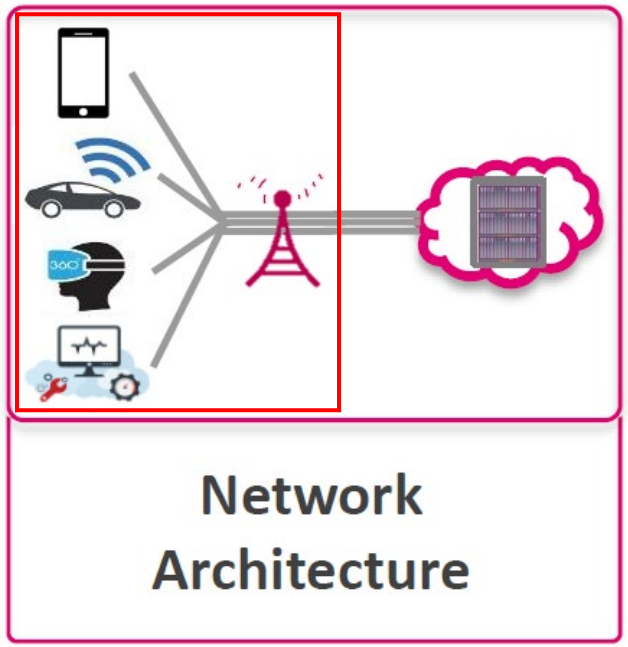


Attachment 4 (T-Mobile Wi-Fi Calling for Government (2009)) at 1. 209

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

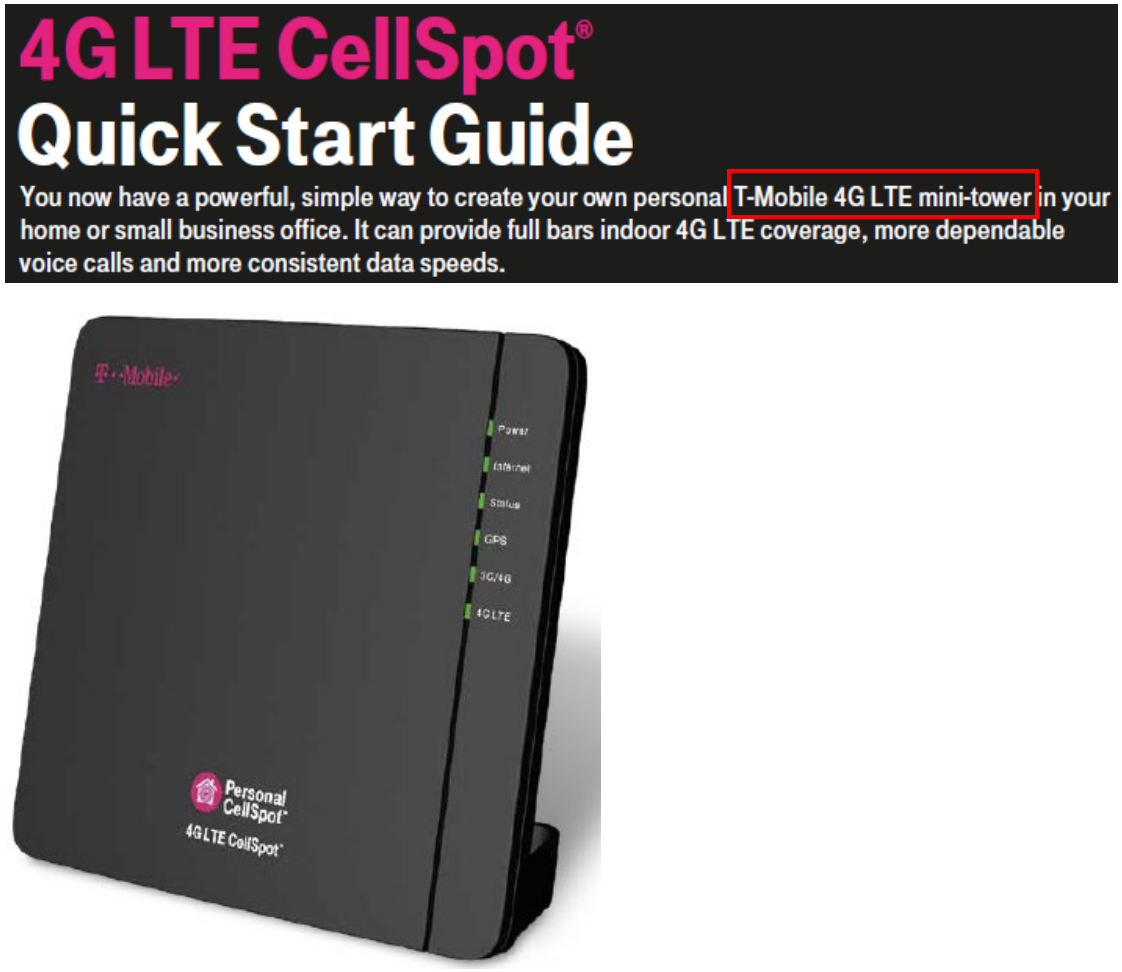


Attachment 5 (Journey to 5G –T-Mobile US Perspective) at 6.



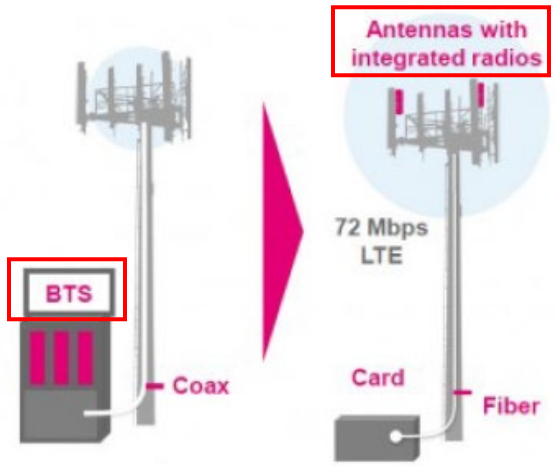
***Id.* at 11.**

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 7 (4G LTE CellSpot® Quick Start Guide (2015)) at 1.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 3 (T-Mobile Announces LTE, Prepares To Take The US Wireless Market By Storm (Webpage, 2012)) at 2.

Industry-first leverages Licensed Assisted Access (LAA) and five-component carrier aggregation on 14 antenna layers

Commercial Nokia AirScale Micro Remote Radio Head (RRH) solution used to aggregate licensed and unlicensed LTE carriers and deliver gigabit speeds with 4×4 MIMO and 256 QAM

Lays ground for enhanced network performance in busy, urban locations on path toward 5G

Espoo, Finland and Bellevue, Washington — February 22, 2018 — Nokia and T-Mobile achieved download speeds of 1.3 Gbps using commercial Nokia technology with Licensed Assisted Access (LAA). This is an industry first using the Nokia commercial AirScale platform to support 14-layer transmissions. This achievement shows how wireless companies like T-Mobile can leverage available licensed and unlicensed spectrum assets to boost performance for customers in high-traffic urban locations, using Nokia's technology for the deployment of high capacity small cells as they evolve network infrastructure toward 5G.

The tests, conducted at T-Mobile's lab in Bellevue, Washington, used commercial Nokia AirScale Micro RRH connected to an AirScale system module. Speeds of 1.3 Gbps were achieved by aggregating LTE carriers in licensed and unlicensed bands using five-component carrier aggregation, 256QAM, 4×4 MIMO and LAA on 14 antenna layers.

Attachment 2 (Nokia and T-Mobile achieve 1.3 Gbpsspeeds using Licensed Assisted Access (2018)) at 1& 2.

INFRINGEMENT CONTENTIONS
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T-Mobile network frequencies & technology

You can check if your phone supports the T-Mobile frequencies below in order to connect to our network. This can get technical, so it's a lot simpler to just use the **IMEI Status Check** if you have the device already.

Devices often support more frequencies than these, in order to roam on other domestic and international wireless networks. They are not needed on the T-Mobile network.

Extended Range (XR) 5G

- With Extended Range 5G, you'll receive nationwide coverage, faster speeds than our 4G LTE and a reliable connection indoors and out from the big city to rural areas.
- Frequencies that can provide XR 5G:
  - **Band n71** (600 MHz)
- Check out **What is 5G?** to learn how it works!

Extended Range 4G LTE

- Frequencies that can provide Extended Range LTE
  - **Band 12** (700 MHz)
  - **Band 71** (600 MHz)
- Our Extended Range LTE signal reaches 2X as far and penetrates walls for 4X better coverage in buildings than ever before.

4G LTE

- Frequencies that can provide LTE:
  - **Band 2** (1900 MHz)
  - **Band 5** (850 MHz)
  - **Band 4** (1700/2100 MHz)
  - **Band 66** (Extension of band 4 on 1700/2100 MHz).
- 4G LTE offers fast download speeds, up to 50% faster speeds than 3G. See **Data speeds**.
- Voice and data services only work at the same time when on you have VoLTE enabled on your device. Otherwise, LTE only provides data.

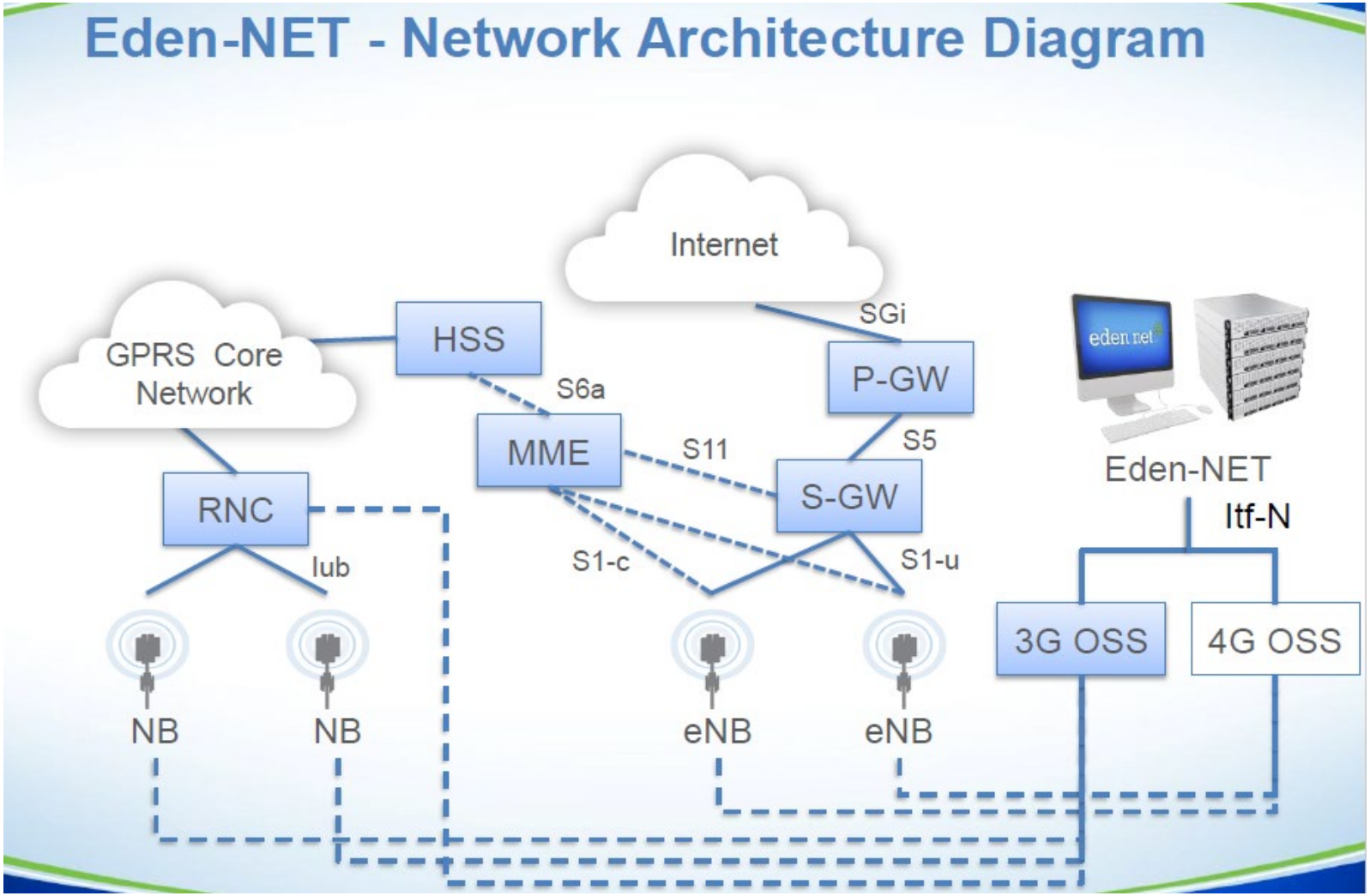
3G (UMTS/HSPA)

- Frequencies that can provide 3G: **Band 4** (1700/2100 MHz) and **Band 2** (1900 MHz)
- Voice and data services can work at the same time. You can use data while on a call.

2G (GSM, GPRS, EDGE)

- Frequencies that can provide 2G: **Band 2** (1900 MHz)
- Voice and data services *don't* work at the same time when on 2G. You cannot use data while on a call.

Attachment 6 (5G & 4G LTE Coverage map (Webpage, 2022)) at 1& 2.



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 37.

INFRINGEMENT CONTENTIONS
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a system of computers programmed to perform steps of referencing performance of at least one of the at least two wireless devices with wireless network known parameters and routinely storing performance data for the at least one of the at least two wireless devices; and	Plaintiff contends that a system of computers a portion of which is executing or loaded with Nokia Eden-Net solution; and operating, implementing and supporting SON solution in the wireless telecommunications network, is programmed to reference performance of the wireless device(s) with wireless network known parameters and to routinely store performance data for the wireless device(s). That is, the system of computers receives or collects UE-referenced network and device performance measurements from the MDT (Minimization of Drive Tests) reports, UE Measurement Reports, etc. and compares the collected (or received) performance data against the corresponding pre-defined standards or thresholds. The system of computers is linked or connected to the wireless network consisting of the various network elements including the radio-tower(s) or base-station(s). Further, plaintiff contends that the system of computers a portion of which is executing or loaded with Nokia Eden-Net solution and operating, implementing and supporting SON solution in the wireless telecommunications network, corresponds to this claim limitation, as the system of computers references performance of the wireless device(s) with wireless network known parameters and routinely stores performance data for the wireless device(s). The system of computers a portion of which is installed or compatible with Nokia Eden-Net solution or Nokia Eden-NET SON-enabled Operations Support Systems (OSS) of T-Mobile's wireless telecommunications network routinely receives the network performance measurements pertaining to RF signal based communications (connections) between base stations and UEs in the said wireless telecommunications network, through Key Performance Indicators or KPIs, Performance Statistics, Performance Indicator, UE Measurement Reports, including MDT (Minimization of Drive Tests) reports. The following exemplifies this limitation's existence in Accused Systems: **Information We Collect Automatically** We automatically collect a variety of information associated with your use of your device (on our network, when roaming, or in WiFi mode) and our products and services, some of which may be associated with you or another user on your account. … For example some of the ways we may automatically collect information include: • Our systems capture details about the type and location of wireless device(s) you use, when the device is turned on, calls and text messages you send and receive (but we do not retain the content of those calls or messages after delivery), and other data services you use. • We may also gather information about the performance of your device and our network. Some examples of the types of data collected include: the applications on the device, signal strength, dropped calls, data failures, and other device or network performance issues. **Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 6.**

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Location-Based Services

We use location information to route wireless communications and to provide 911 service, which allows emergency services to locate your general location. We may disclose, without your consent, the approximate location of a wireless device to a governmental entity or law enforcement authority when we are served with lawful process or reasonably believe there is an emergency involving risk of death or serious physical harm.

Depending on your device, you may also be able to obtain a wide array of services based on the location of your device (for example, driving directions, enhanced 411 Directory Assistance, Find My Device, or search results, etc.). These data services, known as Location-Based Services ("LBS") are made available by us and others, usually via applications. These services use various location technologies and acquire location data from various sources.

These applications and services use various location technologies (including Global Positioning Satellite ("GPS"), Assisted GPS ("AGPS"), cell ID and enhanced cell ID technologies) to identify the approximate location of a device, which is then used in conjunction with the application to enhance the user's experience (for example, to provide driving directions, to provide enhanced 411 Directory Assistance, or search results, etc.)

Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 8 and 9.

Location Data

We may collect your device's location whenever it is turned on (subject to coverage limitations).

Performance and Diagnostic Data

We may collect performance and diagnostic data about your use of our network, networks you roam on, WiFi services or your device. For example, we may collect information about the performance of the device, signal strength, dropped calls, data failures, battery strength and other device or network performance issues. We may also collect information about applications on your device, the fact that an application has been added, when an application is launched or fails to launch, and length of time an application has been running.

Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 5.

Enhanced agility for evolving networks

CommsMEA staff writer, *June 14th, 2016*
Henrique Do Vale, head of sales, applications and analytics, MEA, Nokia explains how Nokia Eden-NET SON solution allows operators to innovate on top of the open framework.

CommsMEA: Tell us about Nokia Eden-NET?

Nokia Eden-NET is a leading Self-Organising Network (SON) solution in the industry with a truly multivendor and multi-technologies approach and a most user-friendly GUI interface. Nokia EdenNET SON can run in open loop or with close loop mode, fully automated and with minimum intervention. Nokia believes that service providers should leverage SON for all network and all layers of radio technology, since it leads to better network quality and better network availability for the end user.

T-Mobile USA has been leveraging Nokia Eden-NET SON. During T-Mobile's SON evaluation process, Eden-NET SON solution simultaneously ensured dropped calls are only fewer, increased throughput, and reduced leakage – even as measured across entire markets, which had been previously well optimised. With Eden-NET SON solution T-Mobile has seen improvements in its network.

Another leading operator has achieved the following by deploying Nokia Eden-NET SON: improvement of handover success-rate by 20%; 5% improvement on voice capacity (Voice Erlangs); 15% reduction in dropped call rates to name a few indicators. These improvements have directly translated into Opex and Capex efficiencies, along with customer satisfaction and bringing a positive impact on its revenues.

Attachment 8 (Enhanced agility for evolving networks (Webpage, 2016)) at 1.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

T-Mobile to use Eden Rock's SON to reduce dropped calls, increase throughput

By **Tammy Parker** • Jun 22, 2014 08:49pm

T-Mobile US (NYSE:TMUS) intends to deploy Eden Rock Communications' self-organizing network (SON) technology nationwide to improve network services.

Founded in 2007, Eden Rock is based in Washington state, as is T-Mobile, Deutsche Telekom's U.S. wireless arm. The vendor's Eden-Net library of SON modules uses cloud-based software intelligence to enhance the performance of 2G, 3G and LTE networks. The SON product works with radio access networks (RANs) provided by multiple vendors to automate the configuration, optimization and maintenance of large-scale modern networks.

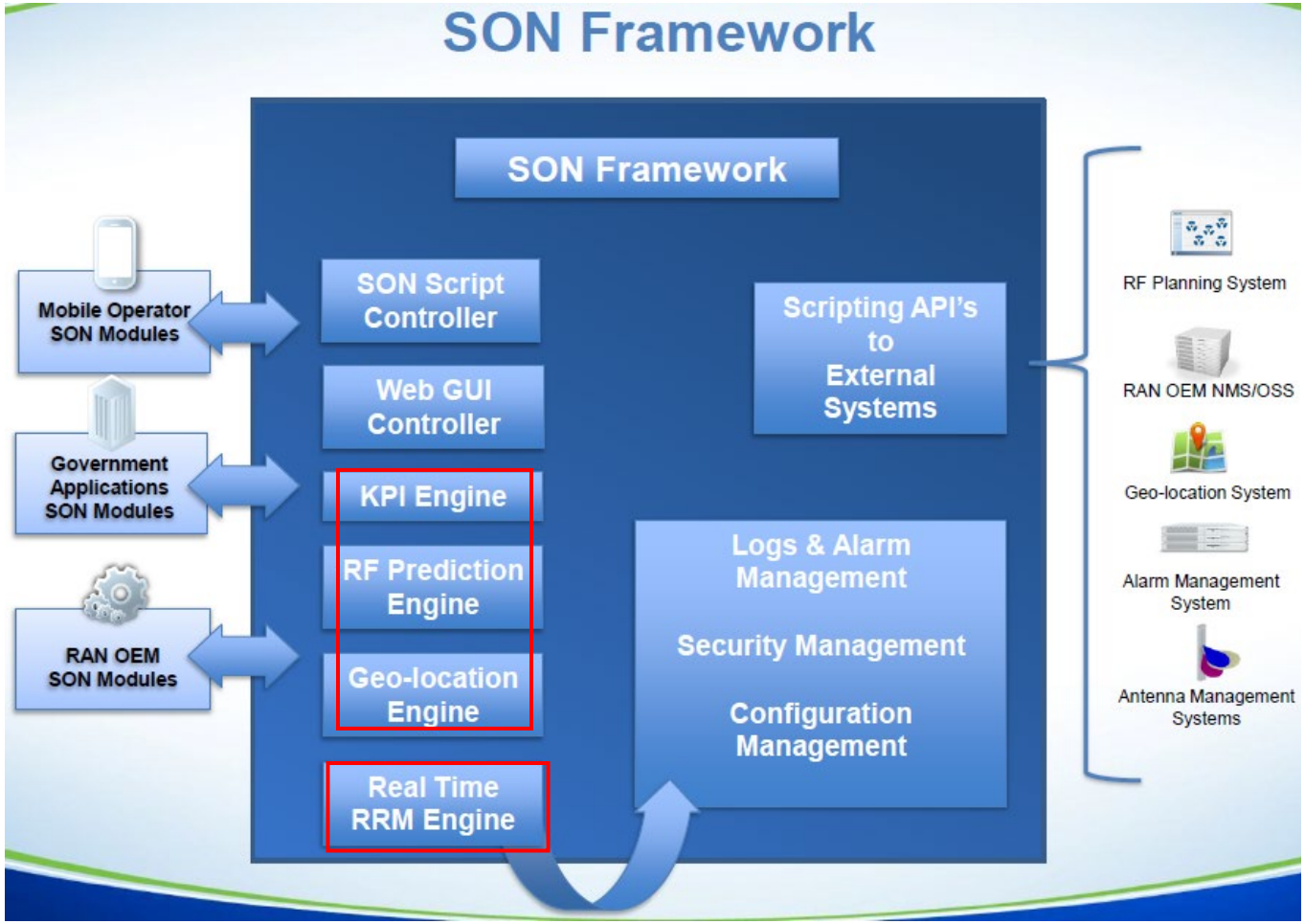
The vendor said that during T-Mobile's SON evaluation process, Eden-Net "simultaneously delivered fewer dropped calls, increased throughput, and reduced leakage--even as measured across entire markets, which had been previously well optimized."

According to Grant Castle, vice president of engineering services and QA for T-Mobile, "with Eden Rock's SON solution we have seen improvements in our network. Furthermore, the operating system framework should enable us to roll out additional SON modules for even further network gains and operational improvements throughout 2014 and beyond."

SON is becoming a key tool for operators as they struggle to handle the growing complexity of their mobile networks. SON technology can be used in multiple ways, including network self-configuration using automatic neighbor relation (ANR) functionality, self-optimization, including traffic load balancing, and self-healing of network problems. ANR, included in 3GPP Release 8, has been described as the most widely deployed SON feature in 3G and 4G.

Attachment 17 (T-Mobile to use Eden Rock's SON to reduce dropped calls, increase throughput _ Fierce Wireless (Webpage, 2014)) at 1 & 2.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 39.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Real-Time Alerts
Nokia Eden-NET

Network challenge

- How to find the degrading performance in the network

Value driver

- Reduced response times to network issues, improved network reliability and a reduction in dropped calls, access failures

Solution

- Eden-NET monitors in real-time a more limited set of KPIs than the Automatic Performance Reports module
- Generates alarms and sends an email to the responsible RF engineer if the KPIs exceed pre-defined or learned thresholds.

	A	B	C	D
1	RNC-303	Time Duration: 07/01/2016 01:11 - 07/01/2016 03:11	Average per 15-Minutes	
2	Cell Name	Cell Dn	Voice Dropped Call Rate	Voice_Calls_Completed
3	PCH42426A21	PLMN-PLMN/RNC-303/WBTS-3426/WCEL-342621	0	10,13
4	PCH42426A22	PLMN-PLMN/RNC-303/WBTS-3426/WCEL-342622	0	9,13
5	PCH22657A32	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165732	0	4,63
6	PCH22657A12	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165712	0	3,75
7	PCH22657A22	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165722	1,02	8,63
8	PCH22657A11	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165711	0	4
9	PCH22657A21	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165721	1,32	7,25
10	PCH22657A31	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165731	0	4,88
11	PCH52109A21	PLMN-PLMN/RNC-303/WBTS-5109/WCEL-510921	0	2,5
12	PCH52109A11	PLMN-PLMN/RNC-303/WBTS-5109/WCEL-510911	16,67	1
13	UCH12114G11	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111411	0	3,75
14	UCH12114G21	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111421	0	4,25
15	UCH12114G31	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111431	1,28	7,63
16	UCH42333B11	PLMN-PLMN/RNC-303/WBTS-4333/WCEL-433311	0	5,25
17	UCH42333B21	PLMN-PLMN/RNC-303/WBTS-4333/WCEL-433321	0	6,88

Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 25.

INFRINGEMENT CONTENTIONS
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Automatic Performance Reports

Nokia Eden-NET

Network challenge

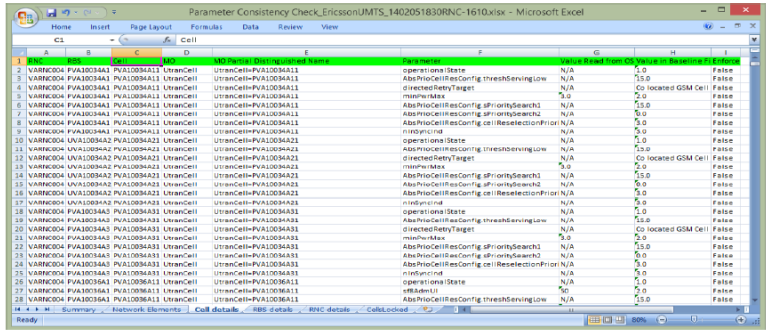
- How to find the worst performing cells in the network

Solution

- Eden-NET processes and analyzes continuously large volumes of performance data across each of the 2G, 3G, and 4G cell e.g.
  - Accessibility KPIs
  - Retainability KPI's
  - Throughput KPI's.
- Identifies the poorest performing cells
- Sends reports to RF Engineers

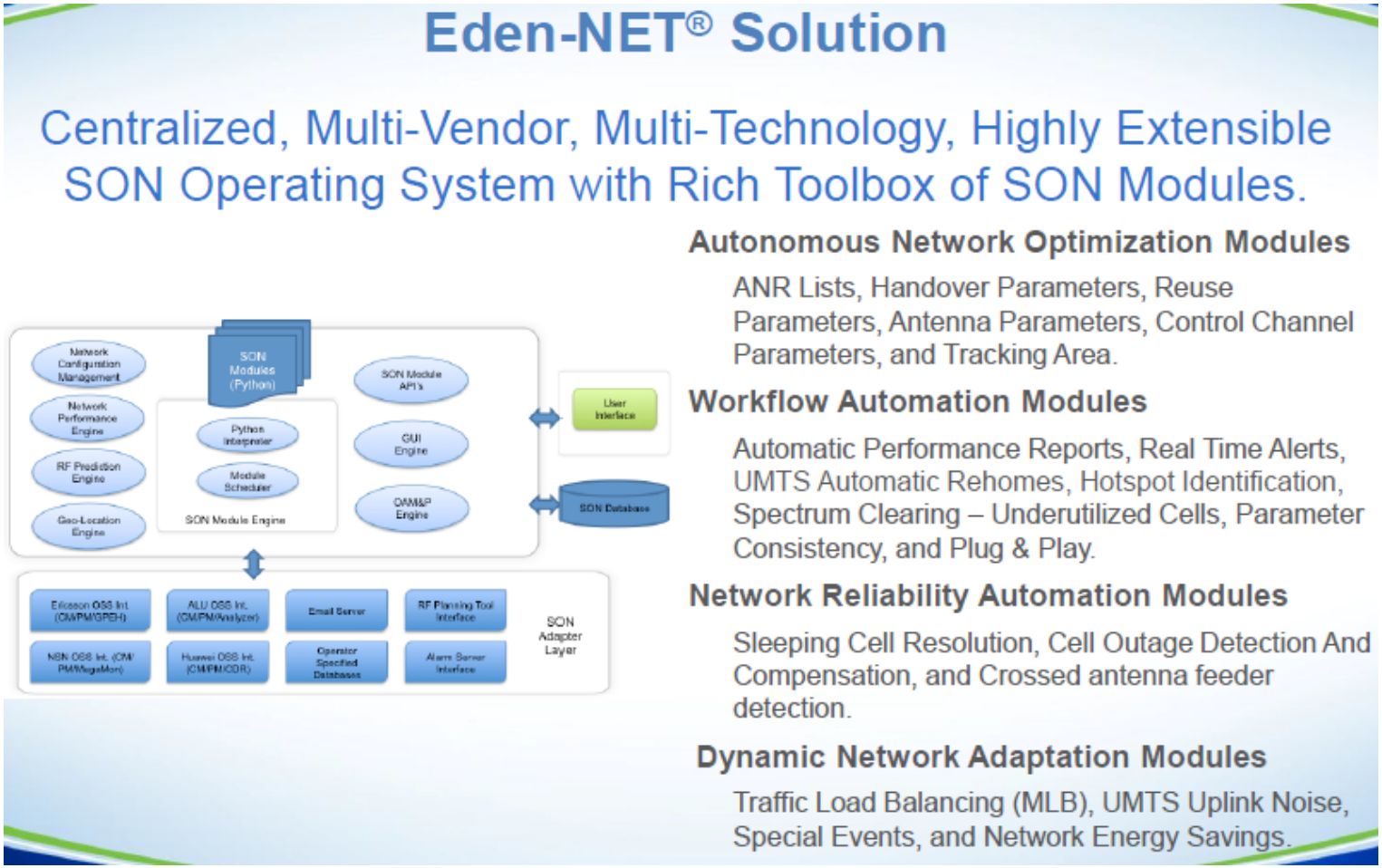
Value driver

- Reduction in manual operational efforts in finding the poor performing network resources



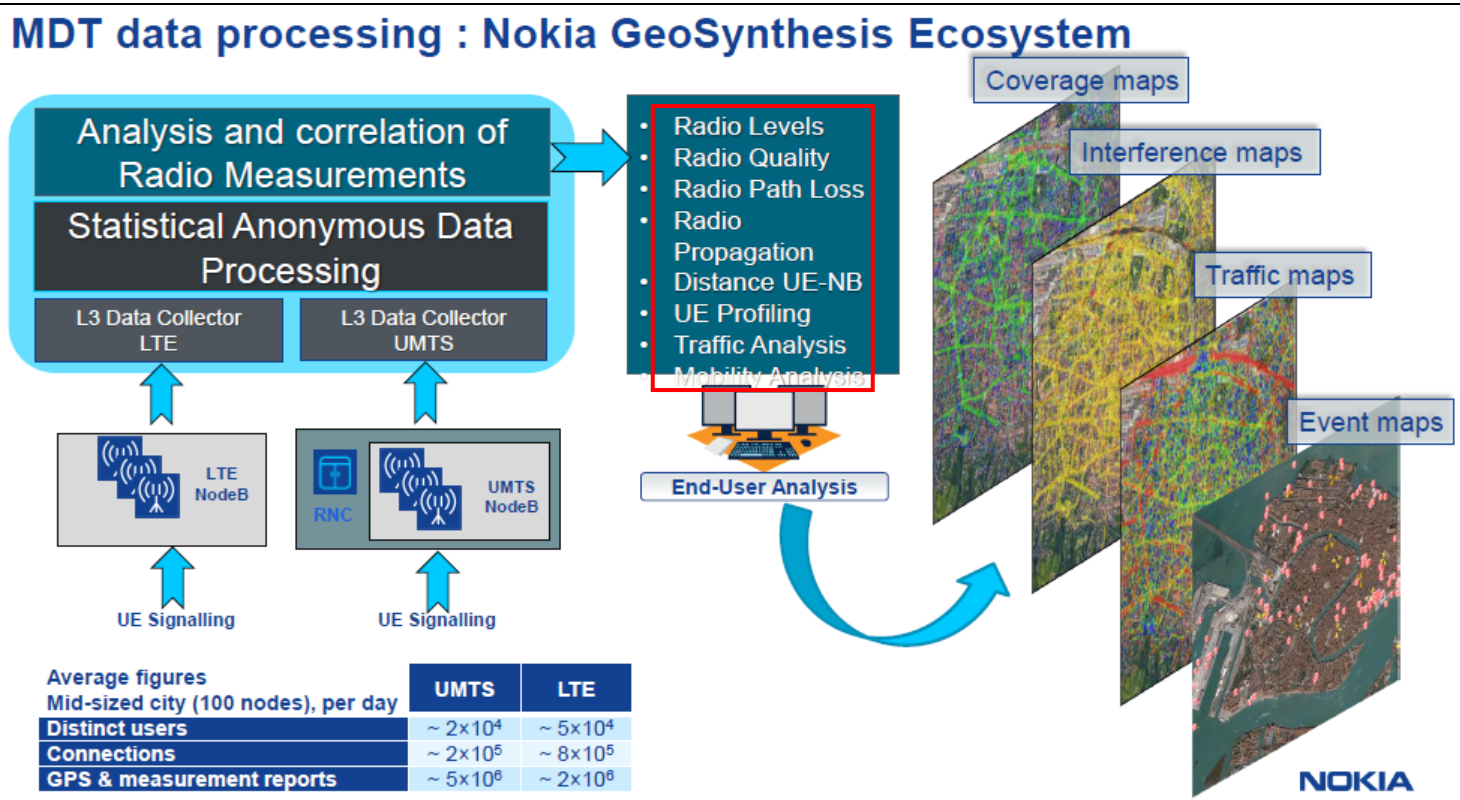
Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 26.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



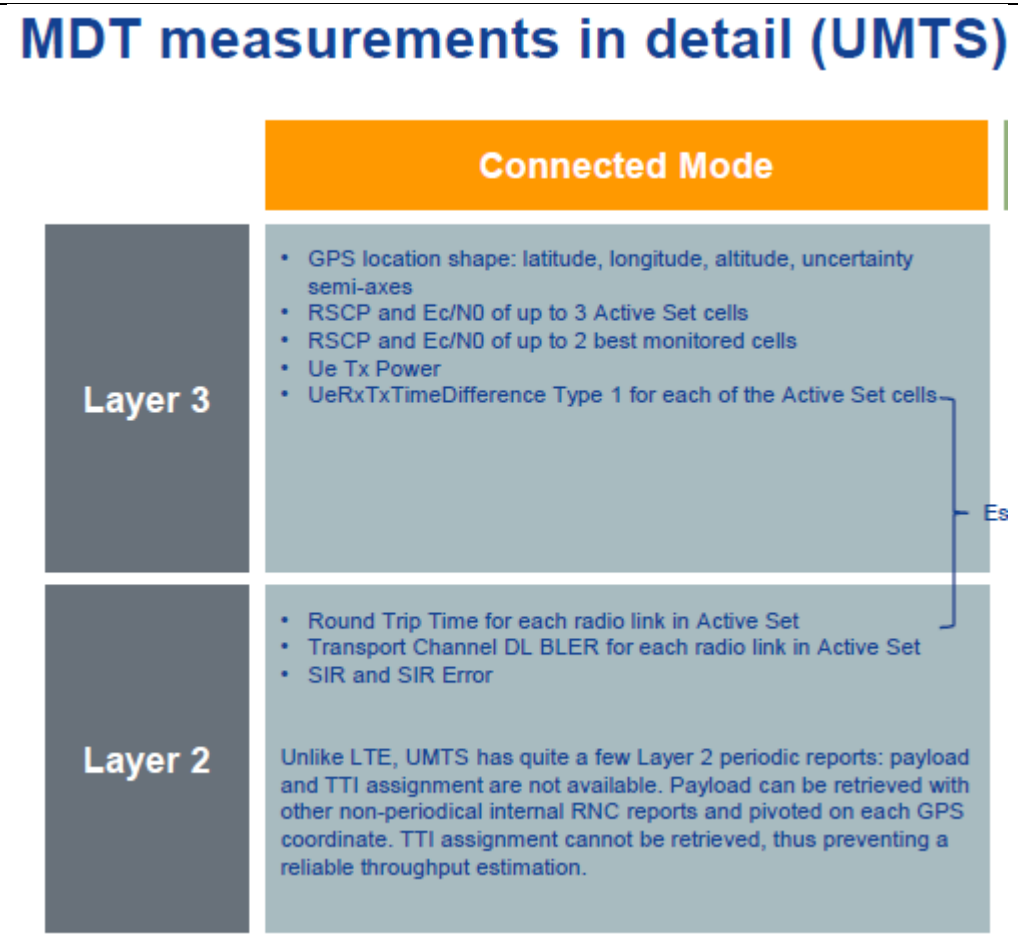
Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 41.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

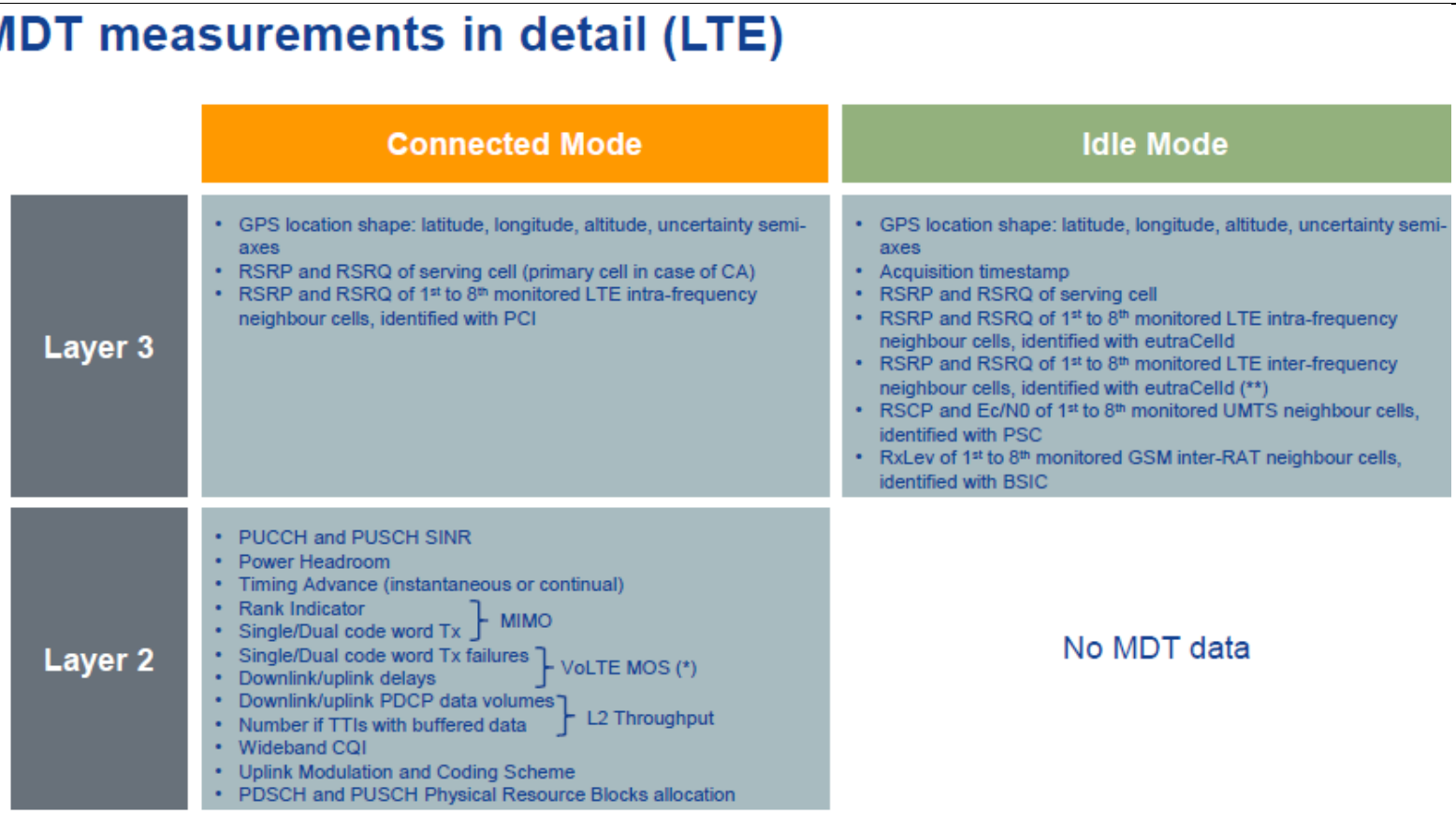


Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 7.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

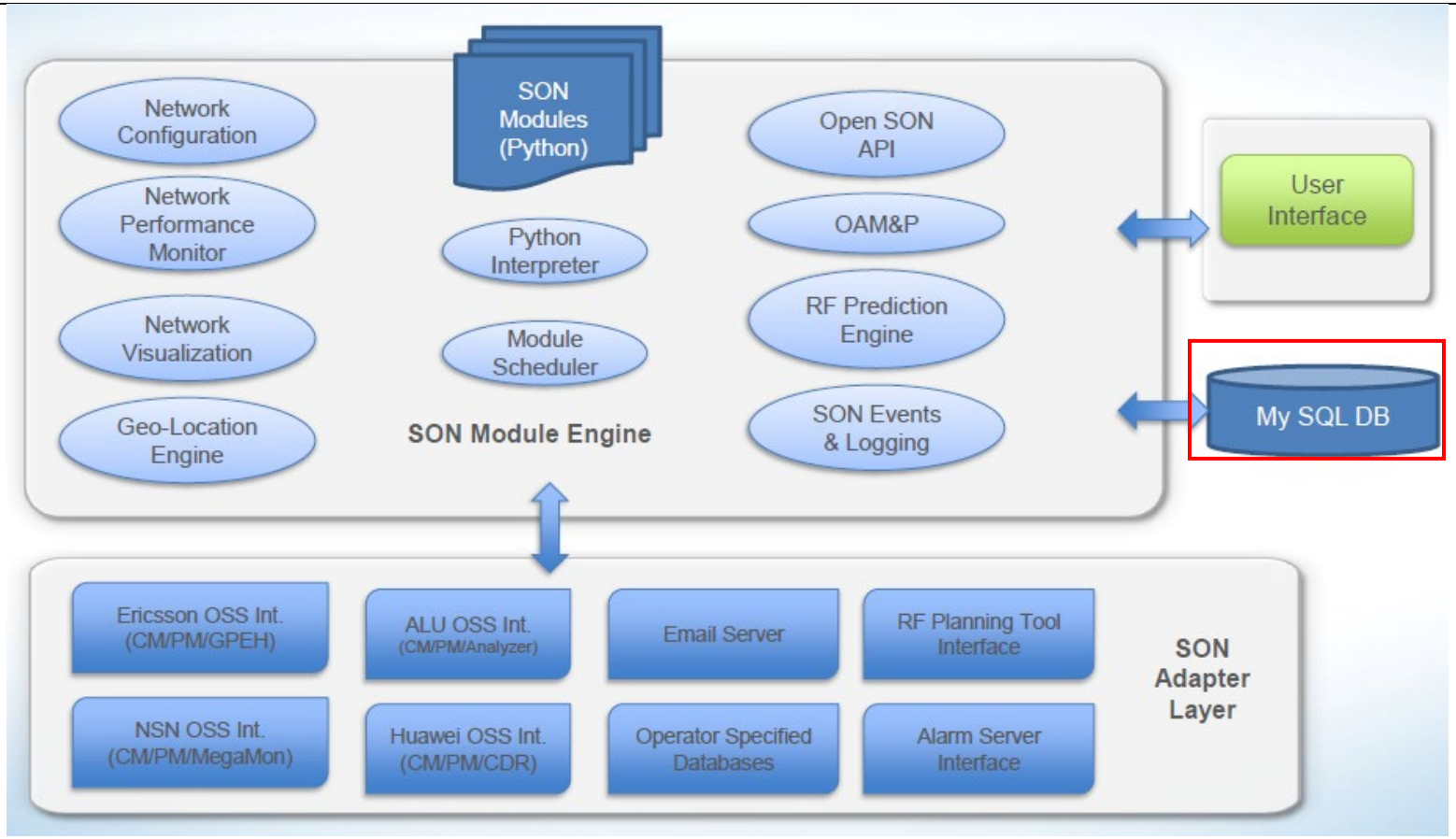


…



Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 9 and 10.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 42.

5.3 LTE1049: MDT - UE Measurement Logs

5.3.1 Description of LTE1049: MDT - UE Measurement Logs

Introduction to the feature

The *LTE1049: MDT - UE Measurement Logs* feature allows the eNodeB to support the configuration and retrieval of user equipment (UE) measurement logs as well as to report those with a cell trace.

…

operators. A minimization of drive tests (MDT) has been proposed in order to meet operator requirements. It is a method of collecting the DT data directly from regular UEs used in the network; it is a less expensive approach to DTs. There are two modes of MDT measurements:

…

The UE measurement logs contain the following information:

- location info (global navigation satellite system (GNSS) information is optional for the UE)
- time stamp
- serving cell ID
- serving cell measurements
- neighbor cell measurements

Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 308 and 309.

3.4 LTE951: Enhanced Cell ID Location Service

3.4.1 Description of LTE951: Enhanced Cell ID Location Service

Introduction to the feature

The *LTE951: Enhanced Cell ID Location Service* feature improves location reporting by introducing enhanced cell ID reporting (E-CID) to the E-Serving Mobile Location Center (E-SMLC).

…

Intra-frequency Reference Signal Received Power (RSRP) and/or Reference Signal Received Quality (RSRQ)

These measurements are performed by a UE and reported to an eNB. When a request for the RSRP, or RSRQ, or both of them arrives at an eNB, the eNB initiates an intra-frequency measurement configuration at the UE with a reportStrongestCells purpose.

The exact type of this measurement is set by the value of triggerQuantity. Subject to a desired measurement, its value is set either to RSRP (in case the RSRP or both measurements are requested), or RSRQ (in case only this measurement is needed).

The UE sends a measurement report to the eNodeB, which in turn sends the RSRP and/or RSRQ measurements to the E-SMLC, which calculates the UE's position.

Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 63 & 66.

The LTE CCO continually assesses the impact of network changes based on network KPIs. It verifies that the implemented changes are having a positive impact on the network by monitoring specific KPIs. These KPIs are selected from the following areas:

- LTE accessibility, retainability, traffic, IRAT volumes, physical resource block utilization and channel quality indicator distributions
- WCDMA accessibility, retainability, traffic, IRAT leakage and handover volumes
- GSM accessibility, retainability, traffic, and handover

Attachment 15 (LTE Coverage and Capacity Optimization Guide (2017)) at 8.

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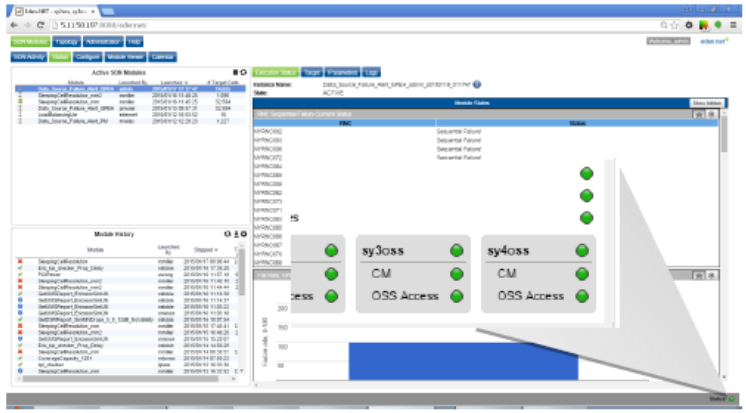
Nokia Eden-NET

- IT System Integrations.

IT System	Availability
PM	†
CM	†
Call Trace	†
Subscriber Geolocation	Q4 '15
FM	Q3 '15
Big Data Systems	'16
Trouble Ticket and Work Order Systems	'16
Inventory management systems	'16
MME OSS: PM, CM Integration	'16
CEM	'16
Drive Test and 3rd Party Probe	'17



The SON Adapter Layer provides a well-structured extensible abstraction layer for interfacing with external systems.

Attachment 11 (Eden-Net with iSON Manager (2015)) at 9.

7 Monitoring SON events

SON events can be monitored under the **Events** tab.

…

INFRINGEMENT CONTENTIONS
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7.1 Viewing events

To view events:

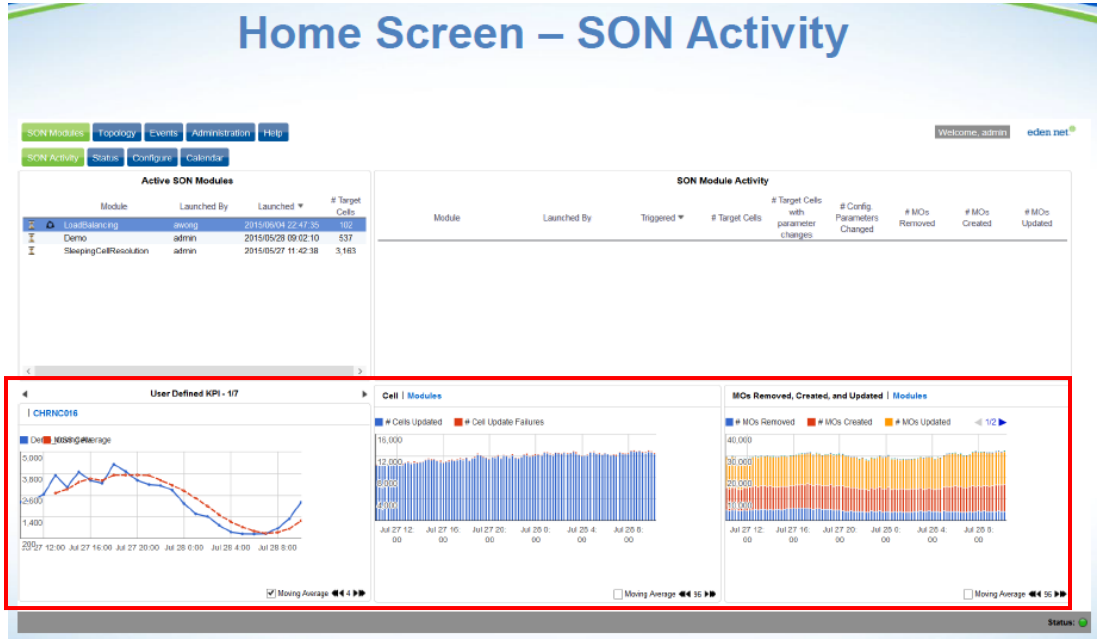
1. *Log in to the Eden-NET application.*
2. Click the **Events** tab.

Expected outcome

The **Events** screen appears, with data input fields and a table containing events.

You can export the table to a CSV file by clicking the **Export table to CSV** icon at the bottom right-hand corner of the events table.

Attachment 12 (Eden-NET User Guide (2017)) at 71.



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 54.

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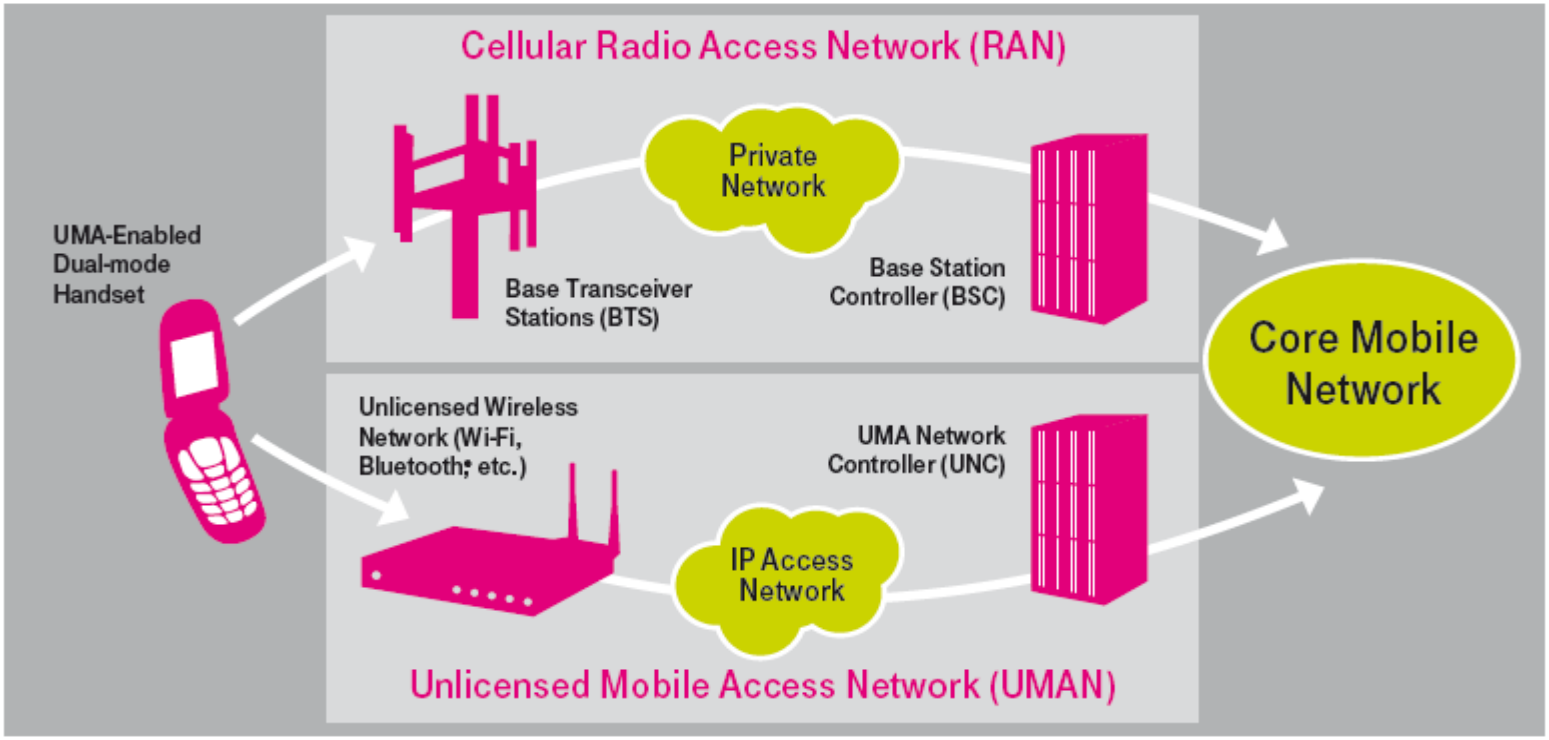
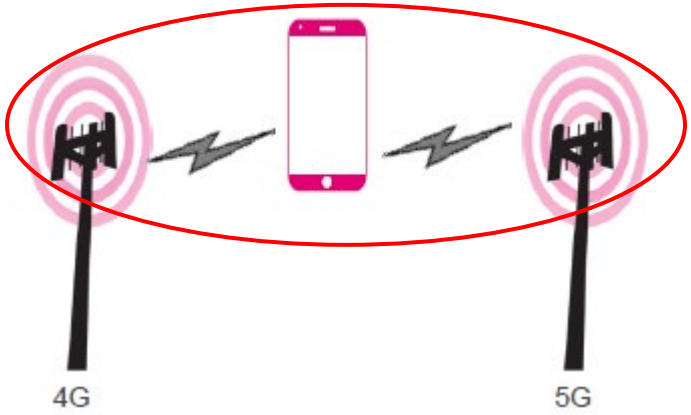
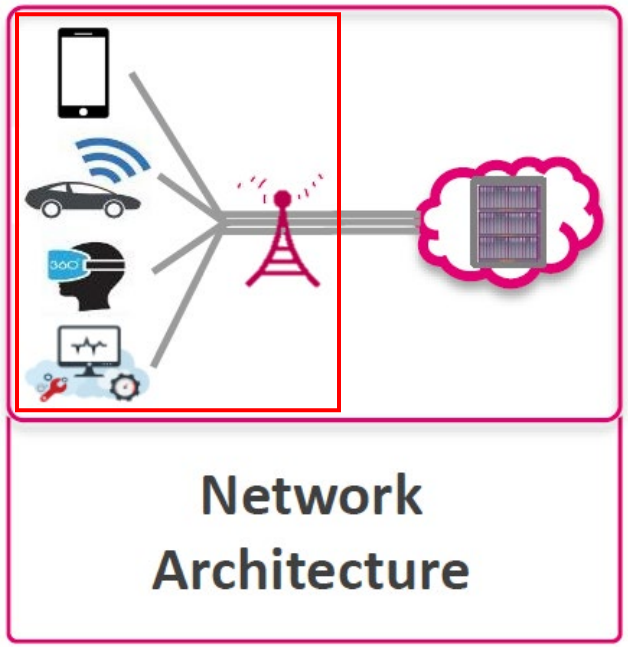
a radio tower adapted to receive the radio frequency signals from, and transmit the radio frequency signals to, the at least one of the at least two wireless devices,	Plaintiff contends that each item listed on Exhibit-A corresponds to this claim limitation because each Exhibit-A item is a radio tower or base station. The T-Mobile's communication network includes cell sites or towers (examples of different types of compatible T-Mobile access points or towers are T-Mobile towers as well as towers sold by third-parties to T-Mobile, See Exhibit-A for more examples) which provide radio communication to and from wireless communication devices (specifically one or more of the mobile wireless communications devices identified on Exhibit-B). Thus, the cell sites (base stations) include the radio frequency transceiver coupled with antenna (Exhibit-A) in T-Mobile's communication network. Towers and base stations include radio-frequency transceivers designed and used for radio-frequency communication with at least one antenna. The following exemplifies this limitation's existence in Accused Systems:  **Attachment 4 (T-Mobile Wi-Fi Calling for Government (2009)) at 1. 209**

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

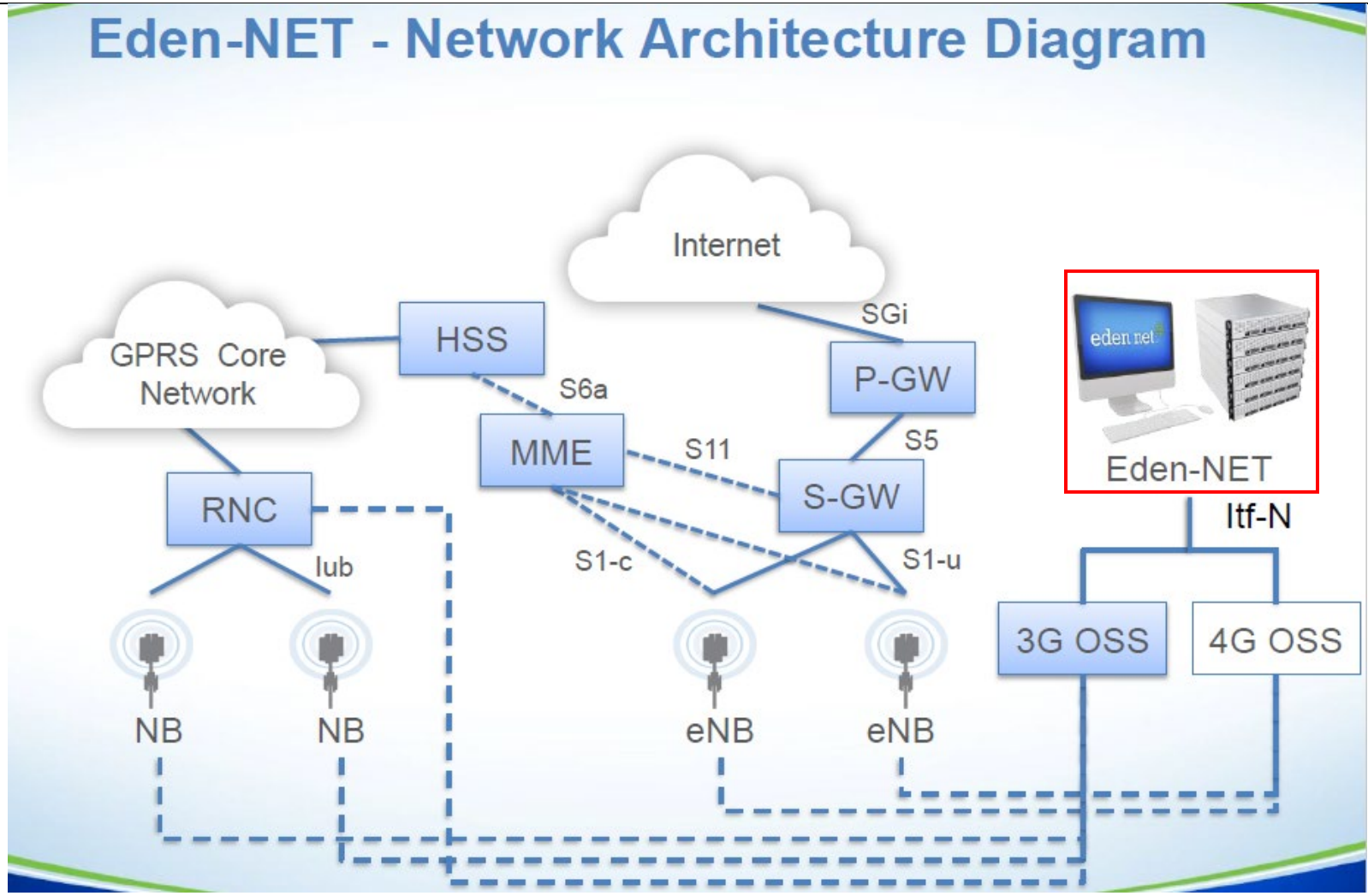


Attachment 5 (Journey to 5G –T-Mobile US Perspective) at 6.



***Id.* at 11.**

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 37.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

wherein the system of computers further receives the performance data and suggests at least one corrective action obtained from a list of possible causes for the radio tower based upon the performance data for the at least one of the at least two wireless devices,	Plaintiff contends that the system of computers a portion of which is executing or loaded with Nokia Eden-Net solution is further programmed to receive the performance data and suggests one or more corrective actions for the radio tower(s) or base-station(s) based upon the performance data for two or more wireless devices. Nokia Eden-NET SON, through its Eden-NET Workflow Automation Modules (Eden-NET Automatic Performance Reports Module and Eden-NET Real-Time Alerts Module, KPI Charts, MDT Reports, etc.), and using Call Location Analysis (CLA), identifies problems in network performance, locations where UEs are experiencing poor network performance (Quality) and the base stations that are performing poorly (the performance of communications or connections of these base stations with the UEs they are serving are below par). Nokia Eden-NET SON, through one or more of its various modules such as Eden-NET Coverage and Capacity Optimization (CCO) Module, Eden-NET Mobility Load Balancing (MLB) Module, Eden-NET Cell Outage Compensation Module, Eden-NET Sleeping Cell Resolution Module, Eden-NET Crossed Antenna Detection Module etc, implements corrective actions on the identified poorly performing base stations (and/or neighbouring base stations, as and when required) based on the identified problems. The following exemplifies this limitation's existence in Accused Systems: Nokia Eden-NET® SON Modules **Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 15.**

SON Module	2G	3G	4G
Automatic Neighbor Relation (ANR)	✔	✔	✔
Reuse Code Optimization (RCO)	N/A	✔	✔
Coverage & Capacity Optimization (CCO)	N/A	✔	✔
Mobility Load Balancing (MLB)	N/A	✔	✔
Crossed Antenna Detection	✔	✔	✔
GSM Frequency Optimization	✔	N/A	N/A
Mobility Robustness Optimization (MRO)	N/A	'18	✔
Automatic Performance Reports	✔	✔	✔
Real-Time Alerts	✔	✔	✔
Parameter Consistency Enforcement (PCE)	✔	✔	✔
Automatic Parameter Optimization (APO)	✔	✔	✔
Sleeping Cell Resolution	Q2'16	✔	✔
Cell Outage Compensation	N/A	✔	✔
Alarm based Outage Resolution	Q2 '16	Q2 '16	Q2 '16
Carrier Aggregation Configuration	N/A	N/A	Q2'16

SON Module	2G	3G	4G
Automated Site Creation (ASC)	N/A	Q3 '16	Q2 '16
Special Event Optimization	Q2'16	Q2'16	Q2'16
Green Networks	'16	'17	Q2'16
Uplink Noise Optimization	N/A	Q2'16	N/A
RACH Parameter Optimization	N/A	'17	✔
eICIC Optimization	N/A	N/A	Q4'16
WCDMA Handover Parameter Optimization	N/A	'16	N/A
Hotspot Identification	N/A	'17	'17
Geo Enhanced MLB	N/A	'17	'17
Geo-Enhanced CCO	N/A	'16	'16
VoLTE Optimization	N/A	N/A	'16
Data Correlation	N/A	'18	'18
Tracking Area Optimization	N/A	N/A	'17
MIMO Optimization	N/A	N/A	'18

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

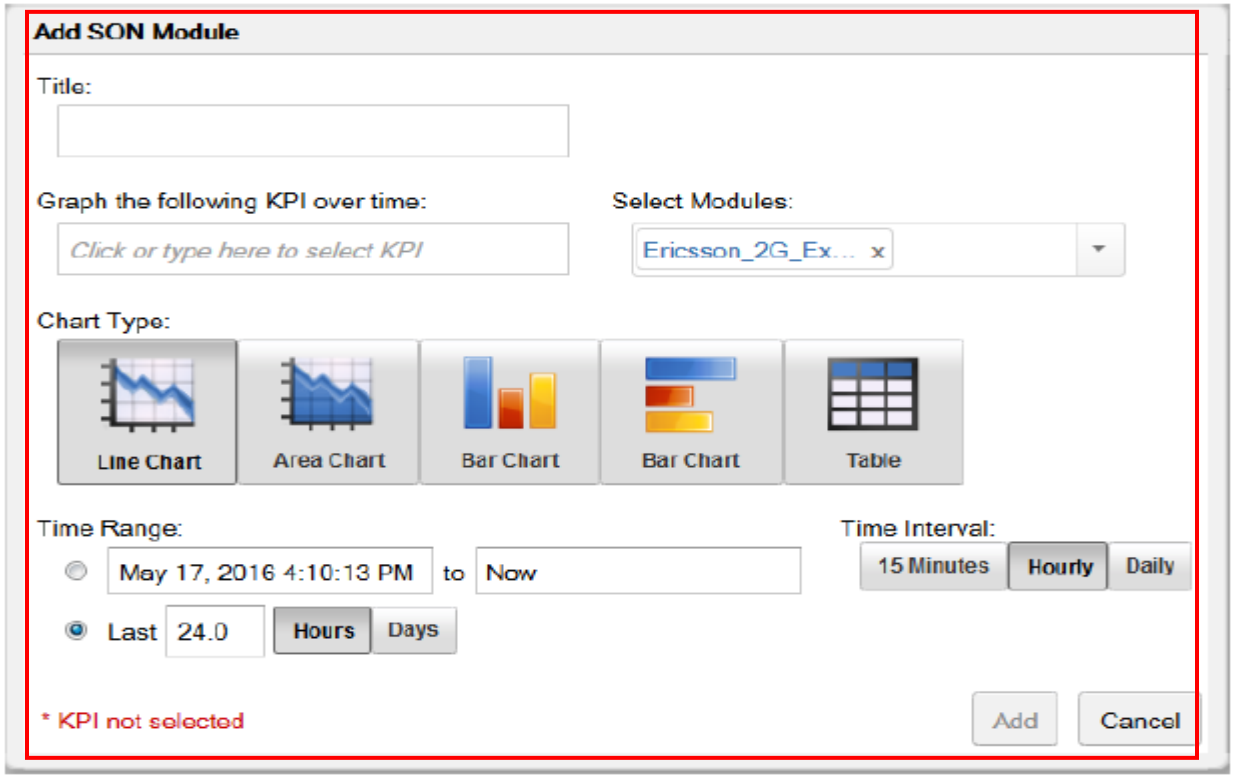
5.1.3 Creating SON Module KPI chart

This screen displays the KPI chart for module level KPIs. These charts display the SON KPI information aggregated for all instances of the same module type, for example, a SON KPI chart for ANR MO additions shows MO additions for all module instances of ANR.

...

4. In **SON KPI Charts** tab, click the **Chart**  icon.

The **Add SON Module** dialog box appears.



Attachment 12 (Eden-NET User Guide (2017)) at 16 and 17.

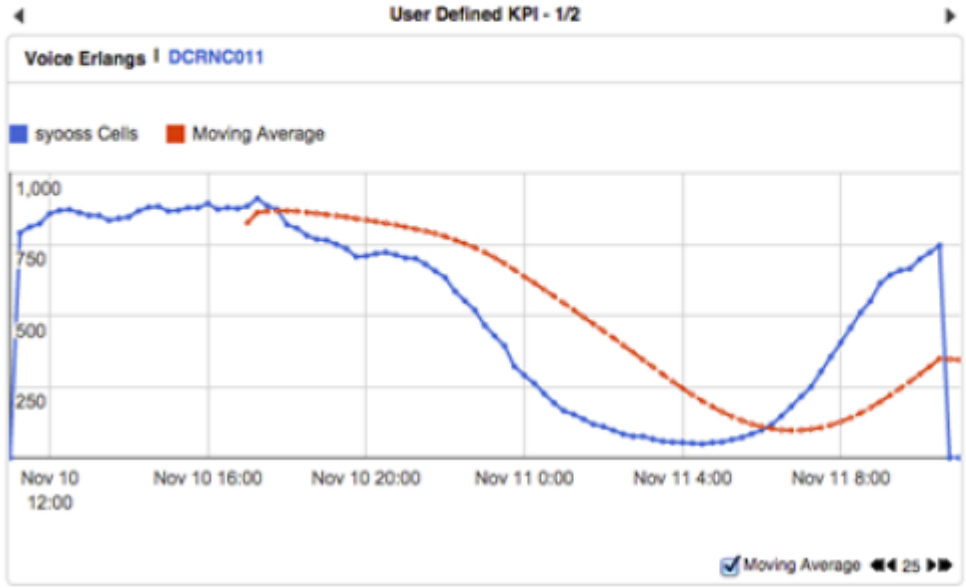
5.1.4 Viewing user defined KPI charts

The User Defined KPI window of the **SON Activity** screen houses charts that graphically represent various Key Performance Indicators. To view charts:

…

User Defined KPI charts are visible below the **SON Module Activity** area.

These charts are user-defined and are configured under the **Topology** tab. Once created, KPI charts can be sent to the home screen for easier accessibility of information.



Attachment 12 (Eden-NET User Guide (2017)) at 18.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

6.2.2 KPI View

The KPI View provides the capability to visually represent cells on the map based on their performance record. For example, a user can configure this view to display cells with a high number of dropped calls as red and cells with a low number as green.

- KPI for configuration
- Date of data (default is Most Recent)
- Resolution (default is Hourly)
- Define the thresholds for the KPIs.

Attachment 12 (Eden-NET User Guide (2017)) at 36.

Nokia Eden-NET grows stronger during Q3-Q4, 2015 - RPCI Highlights

- LTE and LTE RAN integration
- LTE MRO
- Cell Outage Compensation (COC) – KPI based
- Reuse code Optimization for 2G-BCCH
- Alarm based cell outage detection and resolution
- Further ANR Optimization
- Geo-enhanced versions of CCO for 3G and 4G
- First release (**Eden-NET 16EA**) with iSON Manager ported functionality, enabling:
  - Small Cell support
  - Automated Site Creation for WCDMA, LTE, small cells and SingleRAN
  - SON coordinator: Collision avoidance, Auto-verification and Rollback
  - PCI enhancements
  - Inter-RAT MRO

13 Confidential 11/13/15

eden rock communications NOKIA

Attachment 11 (Eden-Net with iSON Manager (2015)) at 13.

4.3.3 SON Module Manager

SON Module Managers are granted all the privileges of SON Module Executor and SON Monitor users. These privileges include:

- Stopping SON Modules
- Configuring, running, and scheduling future SON Module executions
- Viewing the content of SON Modules (when available)
- Retrieving and analyzing SON Module output performance reports
- Viewing and analyzing network performance metrics

Additional privileges granted to SON Module Managers are related to the management of available SON Modules and SON priorities. Specifically, these include:

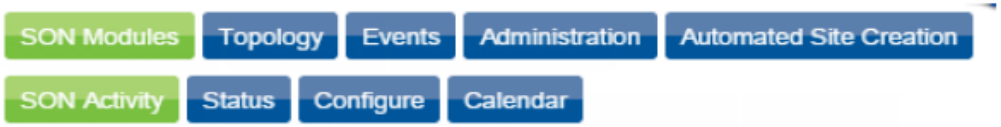
- Setting both user and module priorities
- Managing advanced SON Module configuration
- Configuring SON Module default parameter values
- Configuring SON Exclusion List
- Configuring Black and White Lists
- Executing Network Rollback

Attachment 12 (Eden-NET User Guide (2017)) at 10 and 11.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

5 Monitoring SON Modules

This section provides information on the Eden-NET home screen: SON Activity. The home screen is split up into sections showing information that relates to all SON Modules, individual module iterations, and visualizations of SON activity based on KPI performance data.



5.1 Monitoring SON activities

SON activities are monitored in the **SON Activity** screen under the **SON Modules** tab.

5.1.1 Viewing active SON Modules and SON module activity

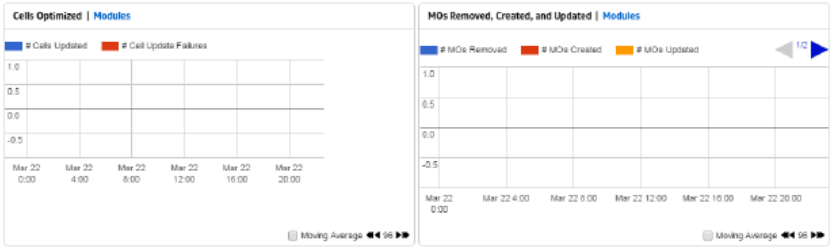
The Active SON Modules area of the SON Activity screen displays an overview of launch information for the initial instance of active modules.

Expected outcome

The **Active SON Modules** and **SON Module Activity** areas appear.

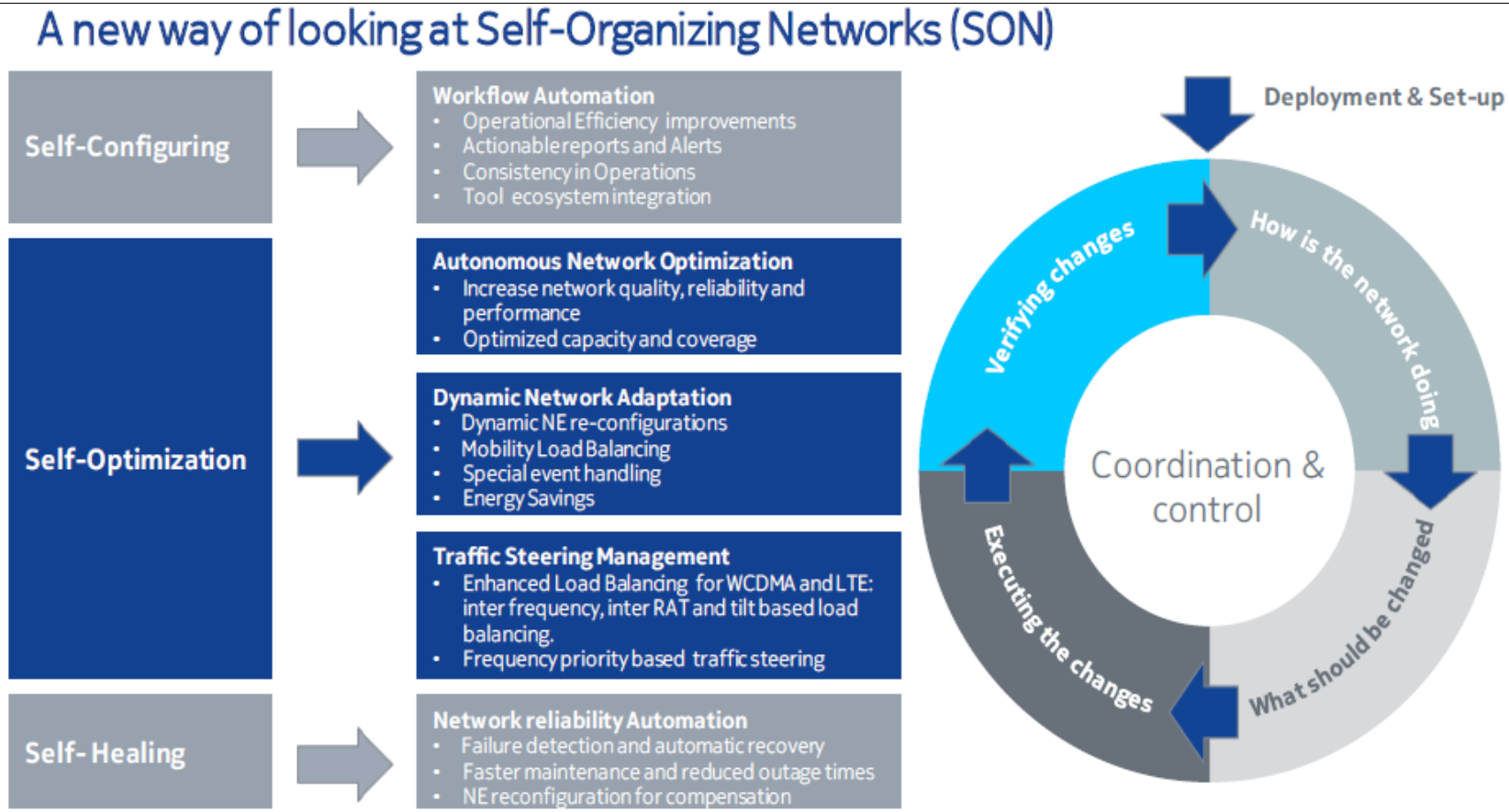
Note:

These parameter and Managed Objects (MO) changes are displayed visually on the SON Activity screen as well. Charts for this information are provided below the **SON Module Activity** area, with titles of Cells Optimized and MOs Removed, Created, and Updated.



Attachment 12 (Eden-NET User Guide (2017)) at 14.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 6.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Autonomous Network Optimization Modules

Coverage and Capacity Optimization (CCO)

Overview:

- The Eden-NET LTE CCO module detects LTE cells that are overshooting and undershooting and apply corrective actions to mitigate this issue through either antenna tilts.
- By controlling the coverage footprint the module shall reduce interference and improve cell capacity.
- The CCO module identifies overshooting and the undershooting cells in the network.
- The CCO module will recommend down-tilting the over-shooters and up-tilting the under-shooters. These recommendations are implemented in an open-loop. In order for these recommendations to be actually implemented, the antennas to be up-tilted or down-tilted need to support RET.
- **Module :** CoverageCapacity / LTECCO
- **Supported vendors and technologies:** Nokia, Ericsson, Huawei, ALU (WCDMA, LTE), ZTE (WCDMA – limited support)

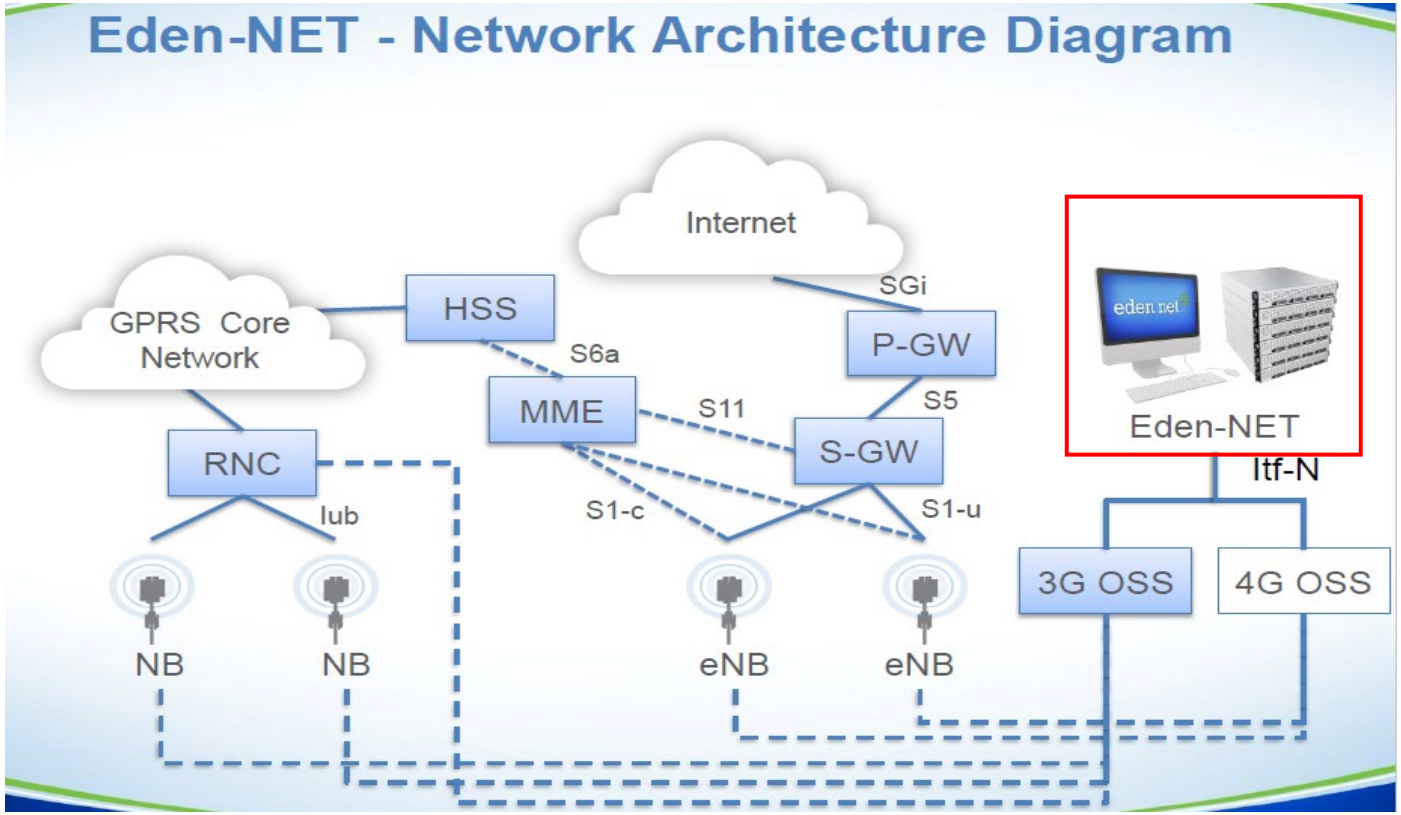
...

3G CCO:
The 3G CCO Module identifies which cells are under-shooters and over-shooters by analyzing the neighbor-directed handover attempts and successes, Detected Set Reporting (DSR), Call Trace Events, antenna location and azimuth information, and tilt score.
Then, this module proposes corrective actions for the most severely undershooting and overshooting cells. The corrective actions will be in-line with the configurable CCO policies, such as: max tilt adjustment, or power adjustment per iteration.
The up-tilt or down-tilt actions of the antenna beam will be either done as open-loop or closed-loop modes.
Finally, this module generates a report with all the changes performed during the closed-loop implementation. Closed-loop means that the configuration changes are actually implemented to the antenna with the help of RET after execution.

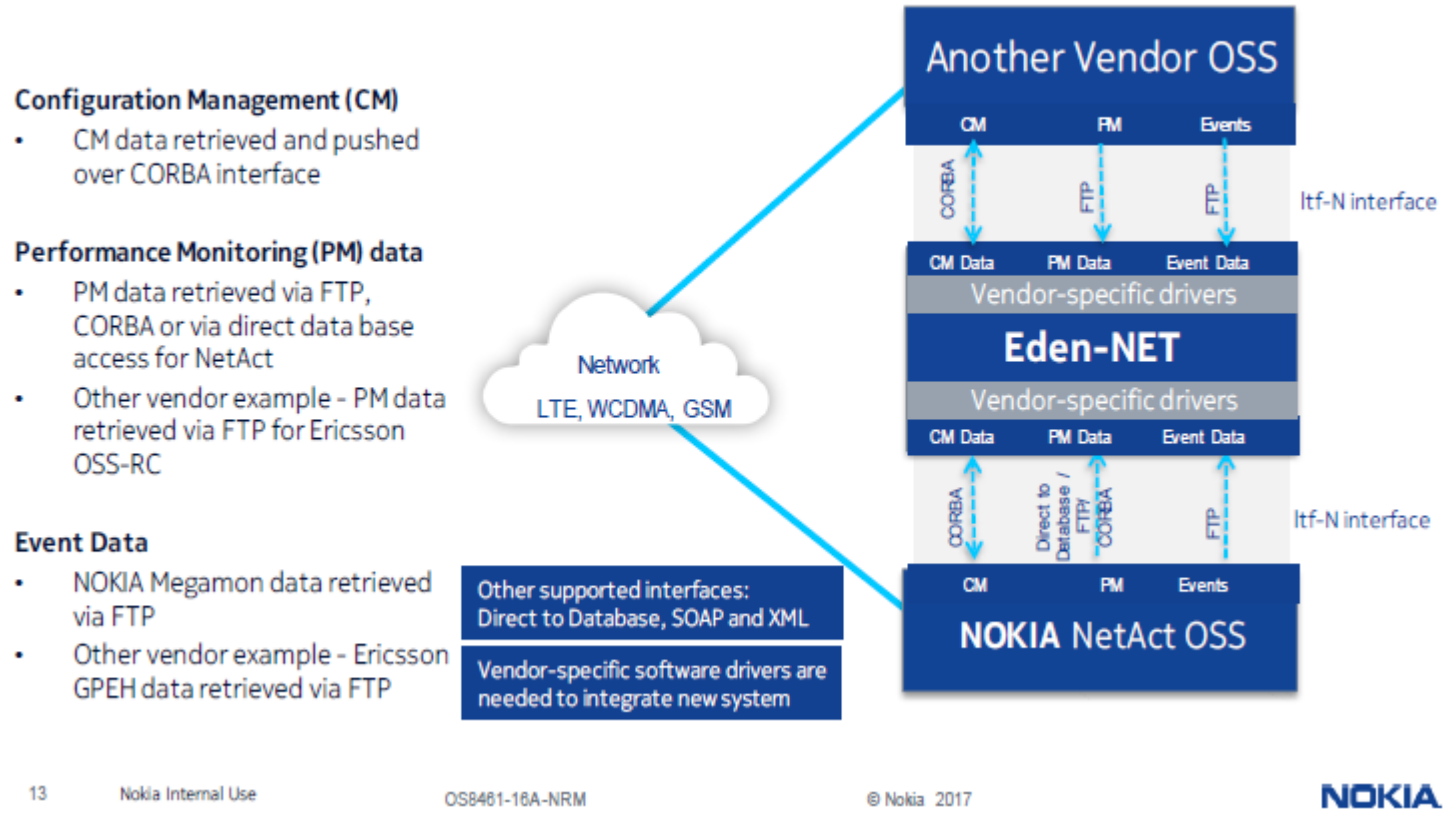
4G CCO: The 4G CCO module uses several handover, antenna, location, neighbor information data, and KPIs to detect under-shooting and over-shooting cells.
The CCO module will recommend down-tilting the over-shooters and up-tilting the under-shooters. These recommendations are to be implemented in open-loop or closed-loop. Open-loop means that the configurations will not be actually applied but just checked for consistency. The closed-loop implementation is actually performed on antennas that support RET.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 29.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

wherein the radio tower generates an error code based upon operation of the at least one of the at least two wireless devices, and	Plaintiff contends that the radio tower or base-station generates an error code (for example, in the form of alerts, alarms, notifications, etc.) based upon operation of one or more wireless devices. Plaintiff contends that each Exhibit-A item, which is a base station including radio transceiver and one or more antennas, when it becomes overloaded by having to service more than an optimum number of active UEs (exhibit B) or due to excessive voice or data traffic, causes an alarm or event or indication or a notification to be raised at the element and/or the network management level (OSS or FM system). The said base station overload alarm or event or indication or notification is communicated to the Nokia Eden-NET SON server, through the SON adapter layer from T-Mobile's wireless telecommunications network's OSS or FM (Fault Management) system. The following exemplifies this limitation's existence in Accused Systems:  **Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 37.**

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 12.

Information We Collect Automatically

We automatically collect a variety of information associated with your use of your device (on our network, when roaming, or in WiFi mode) and our products and services, some of which may be associated with you or another user on your account.

…

For example some of the ways we may automatically collect information include:

- Our systems capture details about the type and location of wireless device(s) you use, when the device is turned on, calls and text messages you send and receive (but we do not retain the content of those calls or messages after delivery), and other data services you use.
- We may also gather information about the performance of your device and our network. Some examples of the types of data collected include: the applications on the device, signal strength, dropped calls, data failures, and other device or network performance issues.

Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 6.

Workflow Automation Modules

- Automatic Performance Reports (includes Worst Performing Cells)
- Real Time Alerts
- Parameter Consistency Enforcement
- Automated Site Creation

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 48.

When a SON module is configured in Eden-NET, thresholds also need to be defined. The module that is in charge of watching the thresholds is called 'Real-Time Alerts'.
The Real-Time Alerts module monitors all the KPIs in the GSM, WCDMA, and LTE networks against the thresholds definitions.
When any KPI breaches its threshold, this module generates a report and notifies the user via email about the worst performing areas.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 51.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Automatic Performance Reports

Nokia Eden-NET

Network challenge

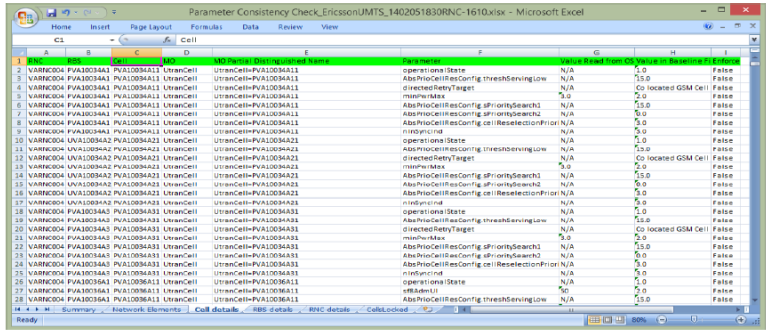
- How to find the worst performing cells in the network

Solution

- Eden-NET processes and analyzes continuously large volumes of performance data across each of the 2G, 3G, and 4G cell e.g.
  - Accessibility KPIs
  - Retainability KPI's
  - Throughput KPI's.
- Identifies the poorest performing cells
- Sends reports to RF Engineers

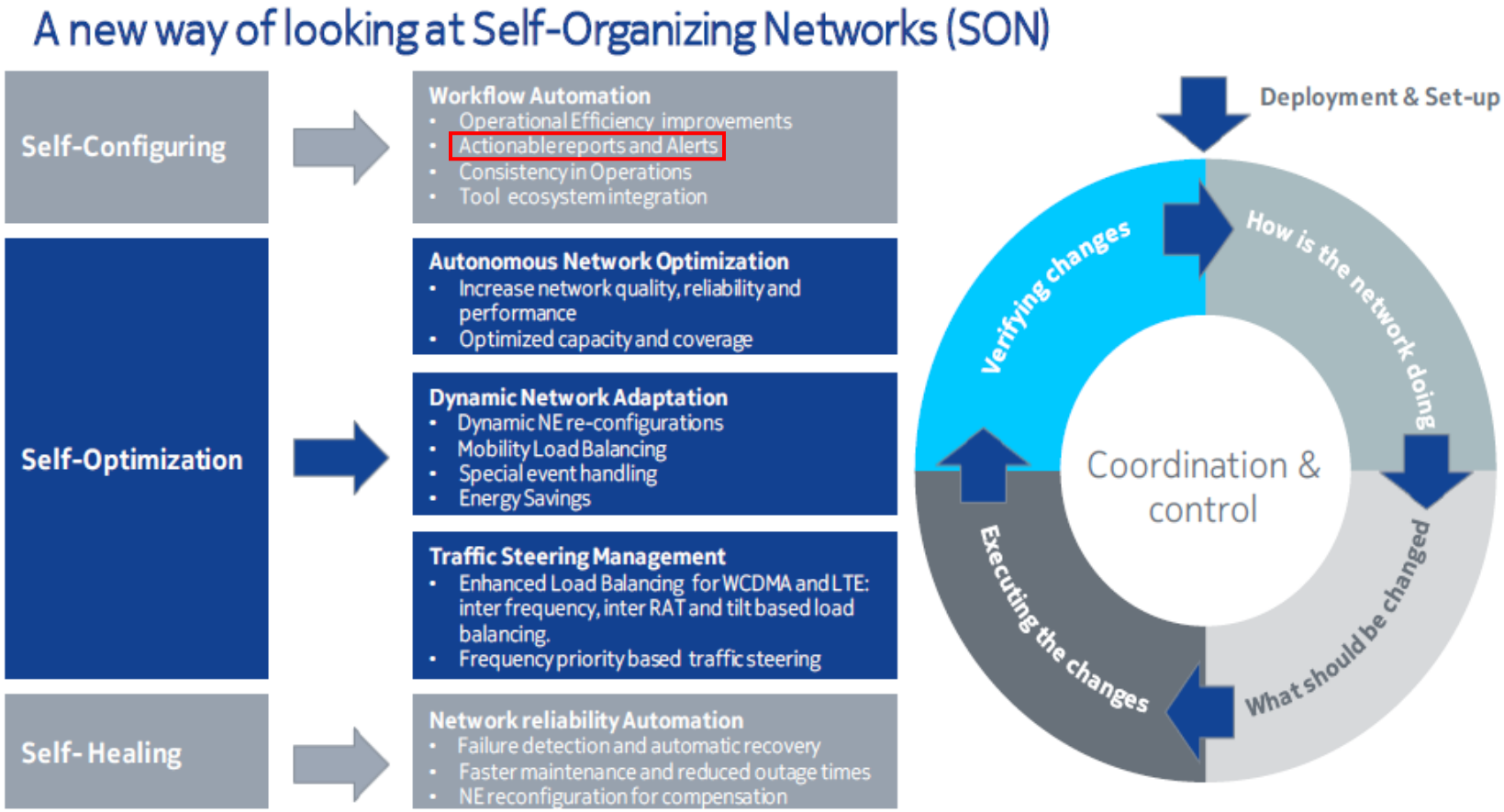
Value driver

- Reduction in manual operational efforts in finding the poor performing network resources



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 26.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

wherein the system of computers is further programmed to receive the error code from the radio tower,	Plaintiff contends that the system of computers a portion of which is executing or loaded with Nokia Eden-Net solution corresponds to this claim limitation. The system of computers performs management functions such as Fault Management (FM), etc. and is capable of receiving network errors or faults from the radio tower(s) or base-station(s) in the form of alerts or alarms or notifications. The following exemplifies this limitation's existence in Accused Systems:  **Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 6.**

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Workflow Automation Modules

- Automatic Performance Reports (includes Worst Performing Cells)
- Real Time Alerts
- Parameter Consistency Enforcement
- Automated Site Creation

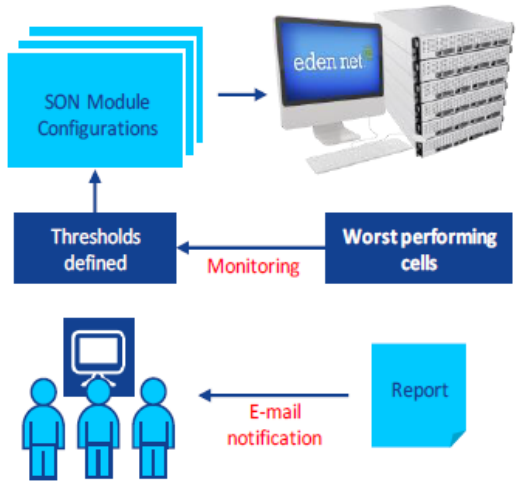
Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 48.

Workflow Automation Modules

Automatic Performance Reports (includes Worst Performing Cells)

Description

- Collect specific KPIs evaluated for a set of target cells.
- Apply a ranking criterion to the collected KPI values.
- Use a performance evaluation window size, which is the number of hours of data over which the cell is evaluated.
- Allow the user to specify the number of cells to be included in a report.
- Send an optional e-mail to the RF engineers with the performance reports.



Benefits

Measurement of the network performance by ranking provided by the module of the worst performing cells due to a KPI value

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 50.

Workflow Automation Modules

Real Time Alerts

Overview:

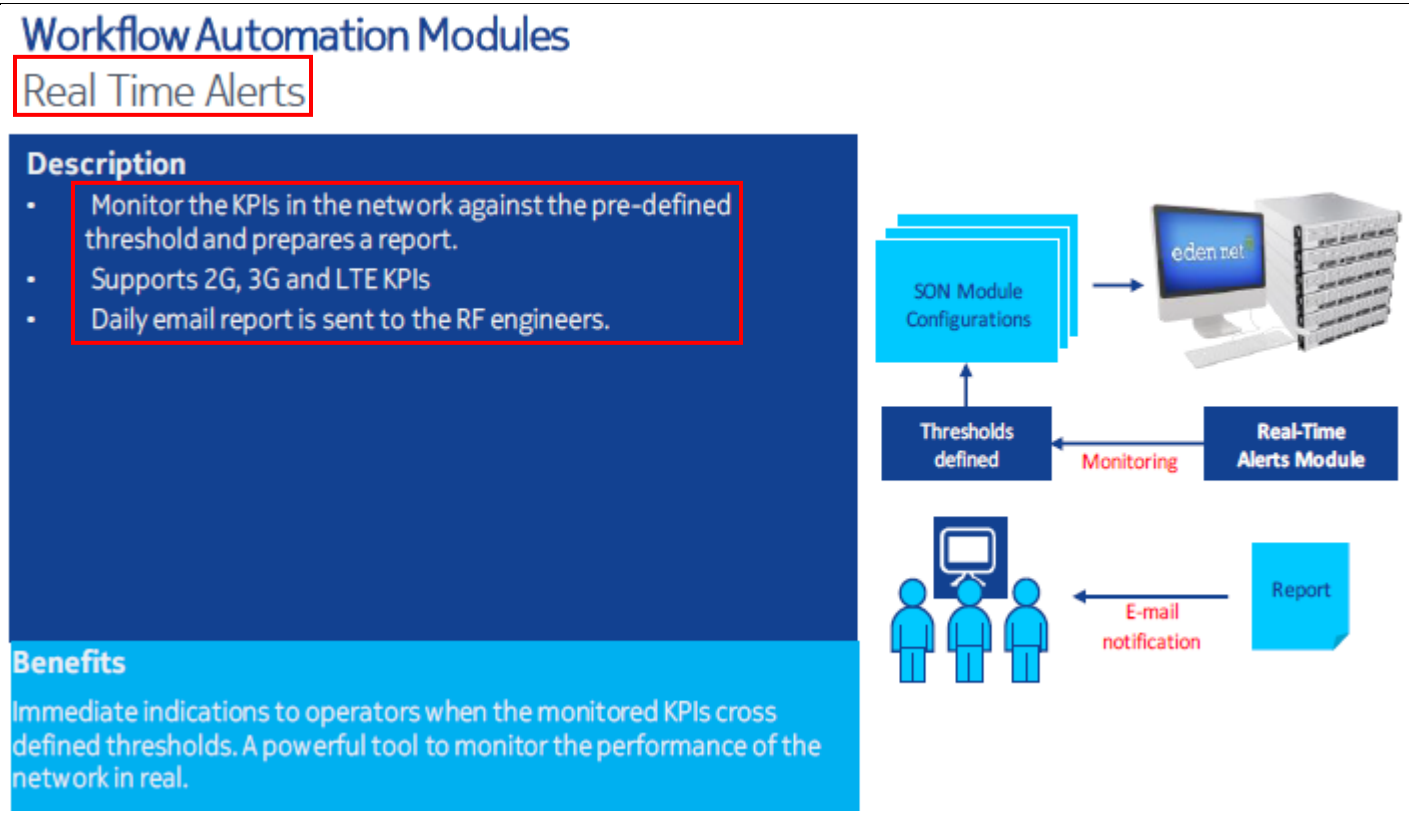
- This module allows the users to evaluate specific KPIs for a set of target cells based on a set of predefined thresholds.
- The module will monitor the KPIs in the network against the pre-defined threshold, prepare report and notify the user via email about worst performing area.

…

When a SON module is configured in Eden-NET, thresholds also need to be defined. The module that is in charge of watching the thresholds is called 'Real-Time Alerts'.
The Real-Time Alerts module monitors all the KPIs in the GSM, WCDMA, and LTE networks against the thresholds definitions.
When any KPI breaches its threshold, this module generates a report and notifies the user via email about the worst performing areas.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 51.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 52.

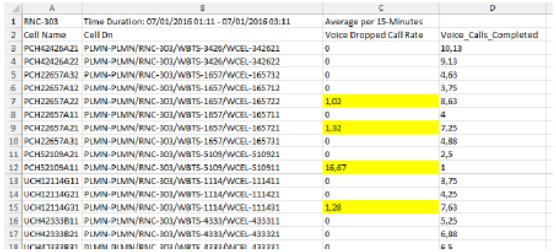
INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Real-Time Alerts
Nokia Eden-NET

Network challenge
- How to find the degrading performance in the network

Solution
- Eden-NET monitors in real-time a more limited set of KPIs than the Automatic Performance Reports module
- Generates alarms and sends an email to the responsible RF engineer if the KPIs exceed pre-defined or learned thresholds.

Value driver
- Reduced response times to network issues, improved network reliability and a reduction in dropped calls, access failures



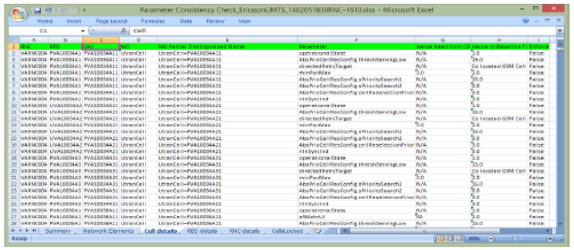
	A	B	C	D
1	RNC-303	Time Duration: 07/01/2016 01:11 - 07/01/2016 03:11	Average per 15-Minutes	
2	Cell Name	Cell Dn	Voice Dropped Call Rate	Voice_Calls_Completed
3	PCH42426A21	PLMN-PLMN/RNC-303/WBTS-3426/WCEL-342621	0	10,13
4	PCH42426A22	PLMN-PLMN/RNC-303/WBTS-3426/WCEL-342622	0	9,13
5	PCH22657A32	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165732	0	4,63
6	PCH22657A12	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165712	0	3,75
7	PCH22657A22	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165722	1,02	8,63
8	PCH22657A11	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165711	0	4
9	PCH22657A21	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165721	1,32	7,25
10	PCH22657A31	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165731	0	4,88
11	PCH52109A21	PLMN-PLMN/RNC-303/WBTS-5109/WCEL-510921	0	2,5
12	PCH52109A11	PLMN-PLMN/RNC-303/WBTS-5109/WCEL-510911	16,67	1
13	UCH12114G11	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111411	0	3,75
14	UCH12114G21	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111421	0	4,25
15	UCH12114G31	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111431	1,28	7,63
16	UCH42333B11	PLMN-PLMN/RNC-303/WBTS-4333/WCEL-433311	0	5,25
17	UCH42333B21	PLMN-PLMN/RNC-303/WBTS-4333/WCEL-433321	0	6,88

Automatic Performance Reports
Nokia Eden-NET

Network challenge
- How to find the worst performing cells in the network

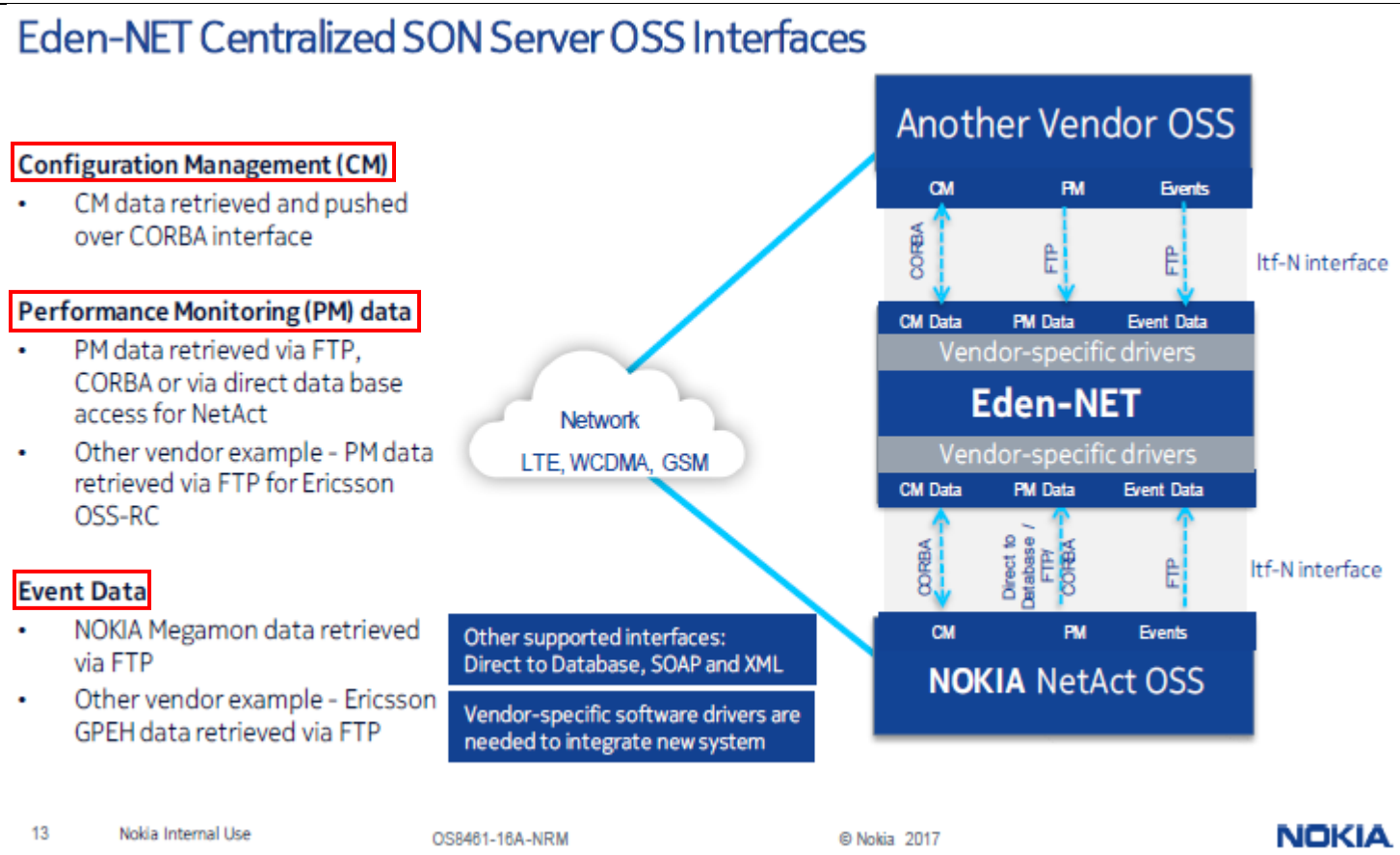
Solution
- Eden-NET processes and analyzes continuously large volumes of performance data across each of the 2G, 3G, and 4G cell e.g.
  - Accessibility KPIs
  - Retainability KPI's
  - Throughput KPI's.
- Identifies the poorest performing cells
- Sends reports to RF Engineers

Value driver
- Reduction in manual operational efforts in finding the poor performing network resources



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 25 & 26.

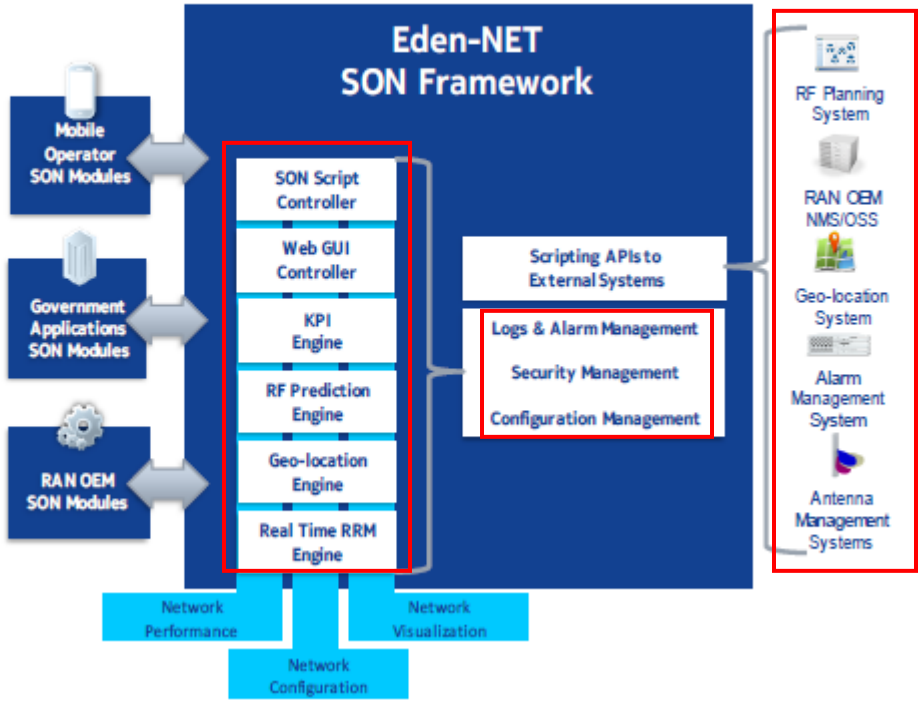
INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 12.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

SON Framework



…

The SON Framework serves the function of operating system for SON that makes easy to the Operators to manage and enable the individual SON modules. The SON Framework interacts with external systems such as OSS/NMS systems, antenna management systems, RF Planning systems, and Alarm Management systems. The scripting framework includes software API's to interface with these external systems.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 11.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

NGMN Ref #	Use Case
Planning Related Use Cases	
[P01]	Base Station Location Planning
[P02]	Base Station Hardware Planning
[P03]	Automatic Generation of Radio Parameters
[P04]	Planning of transport parameters of a new Base Station
[P05]	Planning of security Node, Access GW and Operations and Maintenance Center
Deployment Use Cases	
[D01]	Hardware Installation
[D02]	Network authentication
[D03]	Software Installation
[D04]	Transport Parameter Setup
[D05]	Radio Parameter Setup
[D06]	Testing (Built in Diagnostic/Self Tests)
Optimization Use Cases	
[O01]	Radio Parameter Optimization: Neighbor cell list optimization
[O02]	Radio Parameter Optimization: Interference Control
[O03]	Radio Parameter Optimization: HO parameterization optimization
[O04]	Radio Parameter Optimization: QoS related parameter optimization
[O05]	Radio Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O06]	Transport Parameter Optimization: Routing Optimization
[O07]	Transport Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O08]	Reduction of Energy Consumption
[ERO01]	Capacity Optimization (Congestion Prime)
Maintenance Use Cases	
[Ops01]	Hardware / Capacity extension (Easy plug and play hardware replacement)
[Ops02]	Autonomous Inventory
[Ops03]	Automatic SW Download to Base Station
[Ops04]	Automated NEM upgrade
[Ops05]	Cell outage detection
[Ops06]	Performance Management in real time
[Ops07]	Direct KPI reporting in real time
[Ops08]	Information Correlation for Fault Management
[Ops09]	Subscriber and Equipment trace
[Ops10]	Cell Outage Compensation
[Ops11]	Compensation for Outage of higher level network elements (ASN GW)
[Ops12]	Fast recovery on instable NEM system
[Ops13]	Mitigation of outage of units
[EROps01]	System Availability

Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 10.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 24.

5.3 LTE1049: MDT - UE Measurement Logs

5.3.1 Description of LTE1049: MDT - UE Measurement Logs

Introduction to the feature

The *LTE1049: MDT - UE Measurement Logs* feature allows the eNodeB to support the configuration and retrieval of user equipment (UE) measurement logs as well as to report those with a cell trace.

...

operators. A minimization of drive tests (MDT) has been proposed in order to meet operator requirements. It is a method of collecting the DT data directly from regular UEs used in the network; it is a less expensive approach to DTs. There are two modes of MDT measurements:

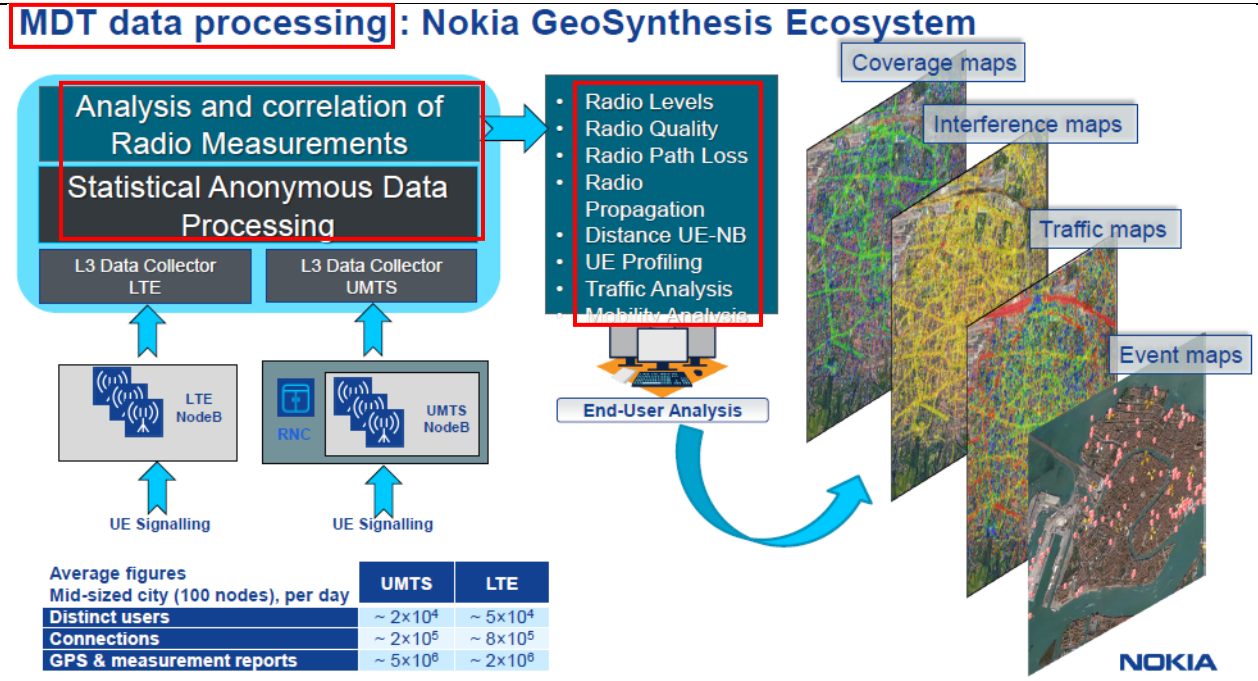
...

The UE measurement logs contain the following information:

- location info (global navigation satellite system (GNSS) information is optional for the UE)
- time stamp
- serving cell ID
- serving cell measurements
- neighbor cell measurements

Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 308 and 309.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 7.

The LTE CCO continually assesses the impact of network changes based on network KPIs. It verifies that the implemented changes are having a positive impact on the network by monitoring specific KPIs. These KPIs are selected from the following areas:

- LTE accessibility, retainability, traffic, IRAT volumes, physical resource block utilization and channel quality indicator distributions
- WCDMA accessibility, retainability, traffic, IRAT leakage and handover volumes
- GSM accessibility, retainability, traffic, and handover

If the module detects that KPIs are degrading after a parameter change has been applied, then the module rolls back the parameters to their previous settings and blacklists the cells.

Attachment 15 (LTE Coverage and Capacity Optimization Guide (2017)) at 8.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Information We Collect Automatically

We automatically collect a variety of information associated with your use of your device (on our network, when roaming, or in WiFi mode) and our products and services, some of which may be associated with you or another user on your account.

…

For example some of the ways we may automatically collect information include:

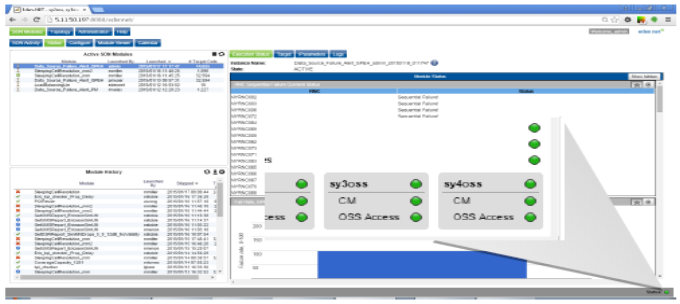
- Our systems capture details about the type and location of wireless device(s) you use, when the device is turned on, calls and text messages you send and receive (but we do not retain the content of those calls or messages after delivery), and other data services you use.
- We may also gather information about the performance of your device and our network. Some examples of the types of data collected include: the applications on the device, signal strength, dropped calls, data failures, and other device or network performance issues.

Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 6.

Nokia Eden-NET

- IT System Integrations.

IT System	Availability
PM	↑
CM	↑
Call Trace	↑
Subscriber Geolocation	Q4 '15
FM	Q3 '15
Big Data Systems	'16
Trouble Ticket and Work Order Systems	'16
Inventory management systems	'16
MME OSS: PM, CM Integration	'16
OEM	'16
Drive Test and 3rd Party Probe	'17



The SON Adapter Layer provides a well-structured extensible abstraction layer for interfacing with external systems.

Attachment 11 (Eden-Net with iSON Manager (2015)) at 9.

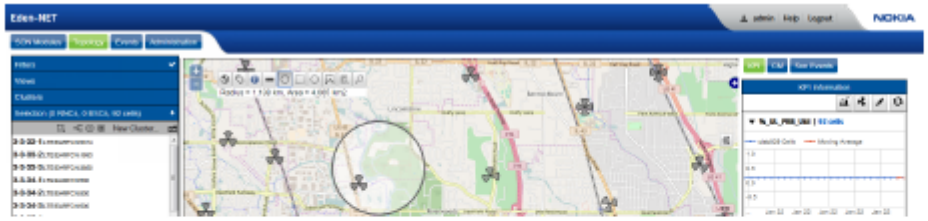
Eden-NET provides users the capability to visualize geographic relationships between targeted network cells. These visualizations and targets are managed via Eden-NET's extensive visualization screens, which support multiple radio access technologies and allow users to quickly receive feedback regarding SON actions applied to network elements.

The contents of this guide develop one's understanding of the functionality and features found throughout Eden-NET and introduce key areas of understanding, including:

- Management of user accounts
- Interacting with network topology maps and network elements
- Configuring and monitoring SON Modules for execution
- Retrieving output files and log reports
- Understanding SON history and status screens
- Defining topology
- Tracking network performance with KPI charts
- Using administrative functions such as Rollback, importing modules, exclusion or inclusion of lists, and configuring account privileges
- Using different map controls
- Managing KPI charts
- Viewing SON events
- Using Automated Site Creation functionality

Attachment 12 (Eden-NET User Guide (2017)) at 7.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Map scale and Lat/Long

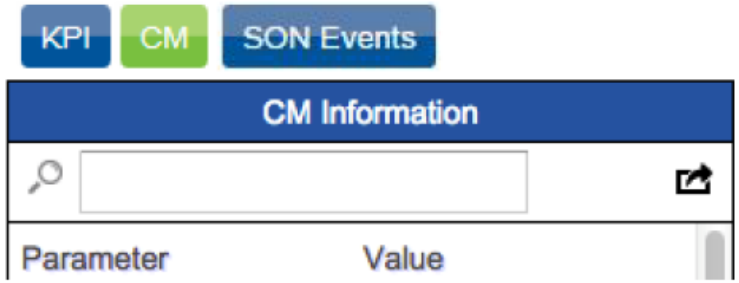
The map's reference scale and geographical Lat/Long coordinates are located on the bottom left and bottom right of the map, respectively.

6.10.3 Cell Information

Eden-NET provides multiple ways to view cell and network information. These include:

CM Information

The CM Information window is found under the same set of tabs as the KPI Information window under **Topology**.

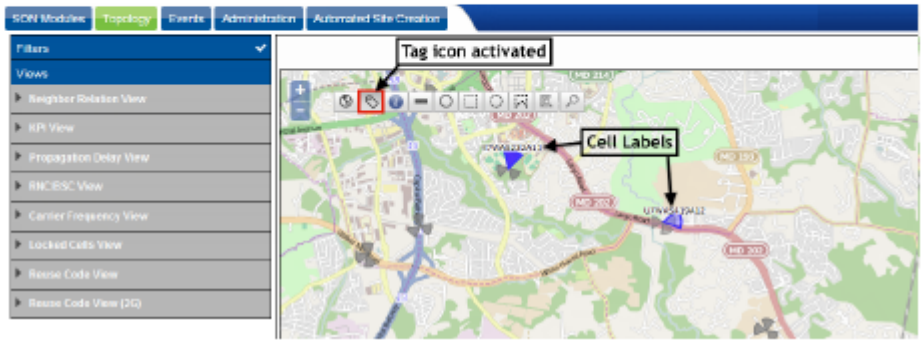


This window provides configuration information for network elements. Select a cell to view its CM information. Cell selection for this purpose can be achieved using the map, the Selection list, or the CM Information text box search tool. The icon allows for the CM Information to either be opened in a new window or exported to CSV.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Cell Labels

The tag icon , located in the map toolbar, activates cell ID labels.



Cell Information Window

The information icon , located in the map toolbar, opens the Cell Information Window when activated. This information window is located in the bottom left corner of the map. To view a cell's information in this window, hover over the cell on the map. Information provided in this window includes:

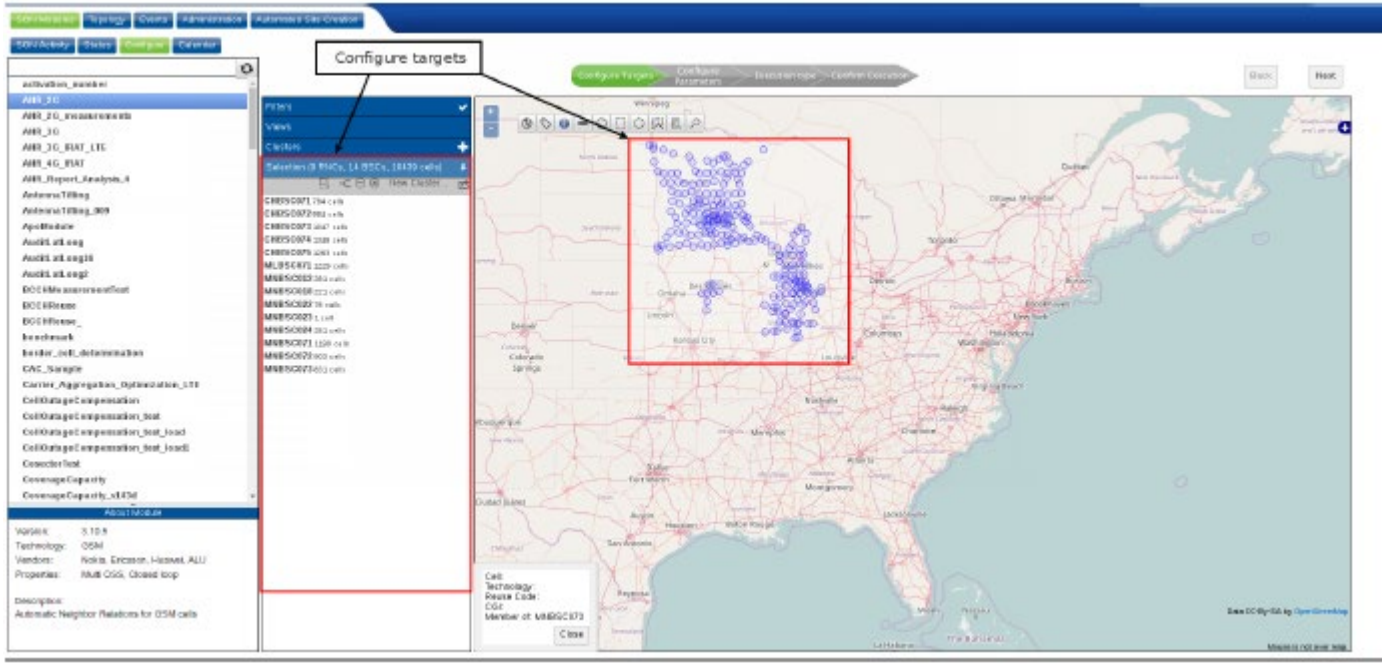
- Cell ID
- Technology (2G, 3G, 4G – Frequency)
- Scrambling Code/PCI Code
- CGI (Cell Global ID)
- Member of RNC/BSC

Attachment 12 (Eden-NET User Guide (2017)) at 69 and 70.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

5.3.1 Configuring targets

Select targets for configuration by using one of Eden-NET's methods for selection of cells. Methods include using map-based or cell name search selection tools from the map toolbar, using existing clusters that have been created, and using Eden-NET's capability for vendor and/or controller (RNC/ BSC) selection. When the SON Module and the target cells are selected, click **Next**.



Attachment 12 (Eden-NET User Guide (2017)) at 28.

6.2.2 KPI View

The KPI View provides the capability to visually represent cells on the map based on their performance record. For example, a user can configure this view to display cells with a high number of dropped calls as red and cells with a low number as green.

- KPI for configuration
- Date of data (default is Most Recent)
- Resolution (default is Hourly)
- Define the thresholds for the KPIs.

Attachment 12 (Eden-NET User Guide (2017)) at 36.

4.3.3 SON Module Manager

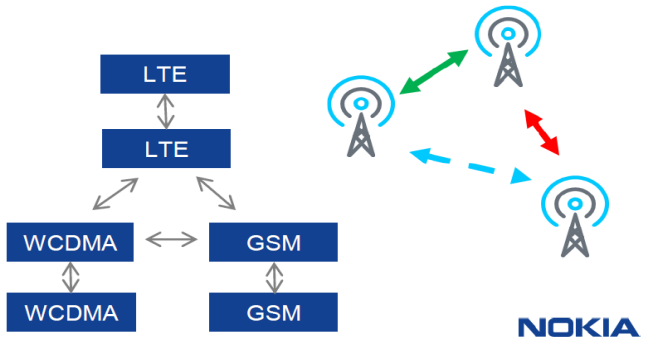
SON Module Managers are granted all the privileges of SON Module Executor and SON Monitor users. These privileges include:

- Stopping SON Modules
- Configuring, running, and scheduling future SON Module executions
- Viewing the content of SON Modules (when available)
- Retrieving and analyzing SON Module output performance reports
- Viewing and analyzing network performance metrics

Additional privileges granted to SON Module Managers are related to the management of available SON Modules and SON priorities. Specifically, these include:

- Setting both user and module priorities
- Managing advanced SON Module configuration
- Configuring SON Module default parameter values
- Configuring SON Exclusion List
- Configuring Black and White Lists
- Executing Network Rollback

Attachment 12 (Eden-NET User Guide (2017)) at 10 and 11.

and selectively suggests the at least one corrective action as a corrective action of the radio frequency signals of the radio tower in order to restrict processing of the radio frequency signals from the at least one of the at least two wireless devices based upon the error code,	Plaintiff contends that the system of computers a portion of which is executing or loaded with Nokia Eden-Net solution is programmed to selectively suggest the one or more corrective actions as a corrective action of the RF signals of the radio tower in order to restrict processing of the RF signals from one or more of the wireless devices based upon the error-code.
	The system of computers can perform SON related functions that require alarm monitoring from the network elements (for example, radio-towers, etc.) and further, the system of computers optimizes the network by adjusting and fine-tuning network parameters such as antenna tilt, transmission power, etc. of the concerned radio-tower(s) or base-station(s) based on RF information. These actions are suggested or performed by the system for automatically adjusting the parameters of the radio-tower(s) or base-station(s) in order to restrict processing of the RF signals from one or more of the wireless devices based upon the error-code.
	The following exemplifies this limitation's existence in Accused Systems:
	Automated Neighbor Relations Optimization (ANR)
	Nokia Eden-NET
	Network challenge
	• Dropped calls
	• Low network throughput
	• Addressing change in a multi-layer network
	• Volatile radio environment
	• Constantly evolving traffic patterns
	Solution
	• ANR optimizes neighbor cell list assignments
	  • Detects and adds missing neighbors
	  • Ranks neighbor list
	  • Removes non-optimal neighbors
	• Effects
	  • Successful handovers → minimal amount of dropped calls
	  • Optimal intra-cell, inter-cell and inter-system handovers between multi-vendor and multi-technology layers
	  • Maximize throughput with optimal handovers
	  • Adapt to constant changes in the radio environment and traffic patterns
	Value drivers (in typical networks)
	• Higher handover success rate, fewer dropped-calls, and lower operational and capital expenses
	KPI improvements
	• >15% Decreased call drop rate
	• Improved throughput
	 
	17 © Nokia Solutions and Networks 2014
	NOKIA
	Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 17.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

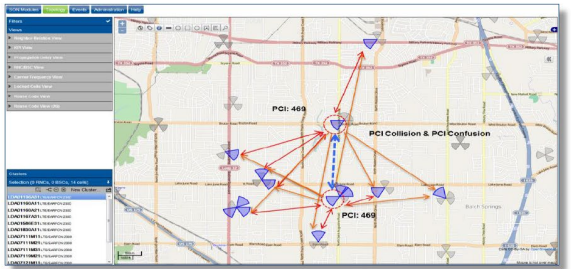
Reuse Code Optimization
Nokia Eden-NET

Network challenge
- Reuse code collisions based dropped calls in the network

Solution
- Detects reuse code collisions/confusions up to four neighbor hops from each other.
- Optimally assigns new codes to cells to eliminate all detected collisions/confusions.
  - Configurable for restricted reuse code ranges.
  - Configurable to maintain common co-sector reuse codes when implementing retunes.
  - Major performance gains experienced once sub-optimal reuse code plans are corrected

Value driver
- Brings several major performance gains such as fewer handover failures and fewer dropped calls

KPI Improvements
- Decreased call drop rate
- Handover success rate



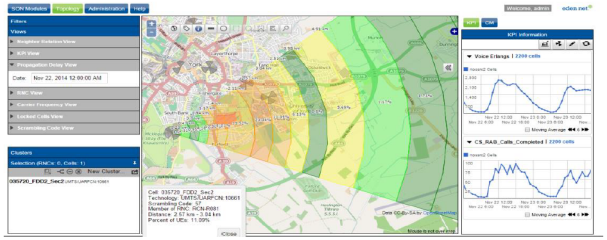
Capacity and Coverage Optimization (CCO)
Nokia Eden-NET

Network challenge
- Optimal network settings are not possible to be reached only by planning
- Manual optimization requires huge effort in constantly changing multilayer network
- Bad behaving cells, such as overshooters, are hard to find manually and they have impacts on wider area
- Balancing between capacity and coverage

Solution
- CCO scans multiple radio access technologies and multiple radio access network vendors to detect coverage gaps, interference and overshooters
- CCO optimizes the coverage via advanced antenna and cell power adjustments

Value driver
- Identification of over-shooting and under-shooting cells to achieve performance gains

KPI Improvements
- 30% Call drop rates (improved voice quality and accessibility)
- 13% Handover success rate
- Average throughput (capacity and spectral efficiency)



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 18 & 19.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

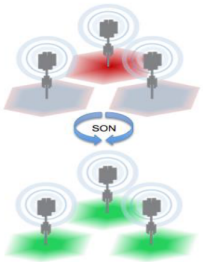
Mobility Load Balancing (MLB)
Nokia Eden-NET

Network challenge
- Part of the cells may be occasionally overloaded, causing access failures and dropped calls
- Ensuring network quality would require building extra capacity

Value driver
- 90% reduced manual operational efforts during cell congestion
- Maintaining network quality in case of peak load without need of extra capacity -> CAPEX savings

Solution
- MLB optimization triggers a redistribution of traffic from the overloaded cells to lightly loaded neighbor cells
- Results in
  - Evenly loaded network
  - Reduced voice and data dropped calls
  - Improved voice and data accessibility

KPI Improvements
- 12% Speech drop rate
- 16% Speech Setup success rate
- Traffic Volumes
- Channel utilization
- Traffic Latency
- Average per-user throughput



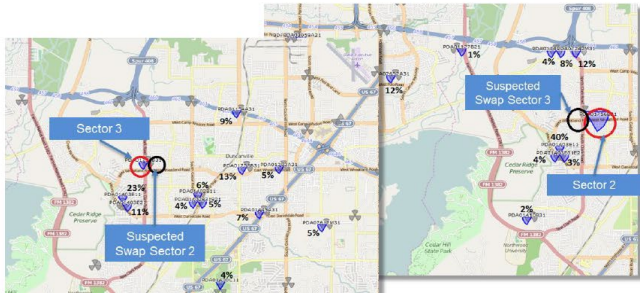
Crossed Antenna Detection
Nokia Eden-NET

Network challenge
- Crossed antenna feeders in the network
- Unexpected results in network functionality and management operations

Solution
- Detects swapped transmit antennas for 2G, 3G and 4G.
- Reports antenna feeder issues with confidence scores.
- Analyzes neighbor lists, geometry of cells, HO counts, neighbor info across frequency layers.

Value driver
- Fast and accurate detection of the problem. Time savings from solving strange optimization results Better user experience by improved network reliability

KPI Improvements (for affected cell)
- 53% Improvement of Intra HO attempts
- 21% Improvement of Inter RAT HO attempts
- 33% Improvement of throughput

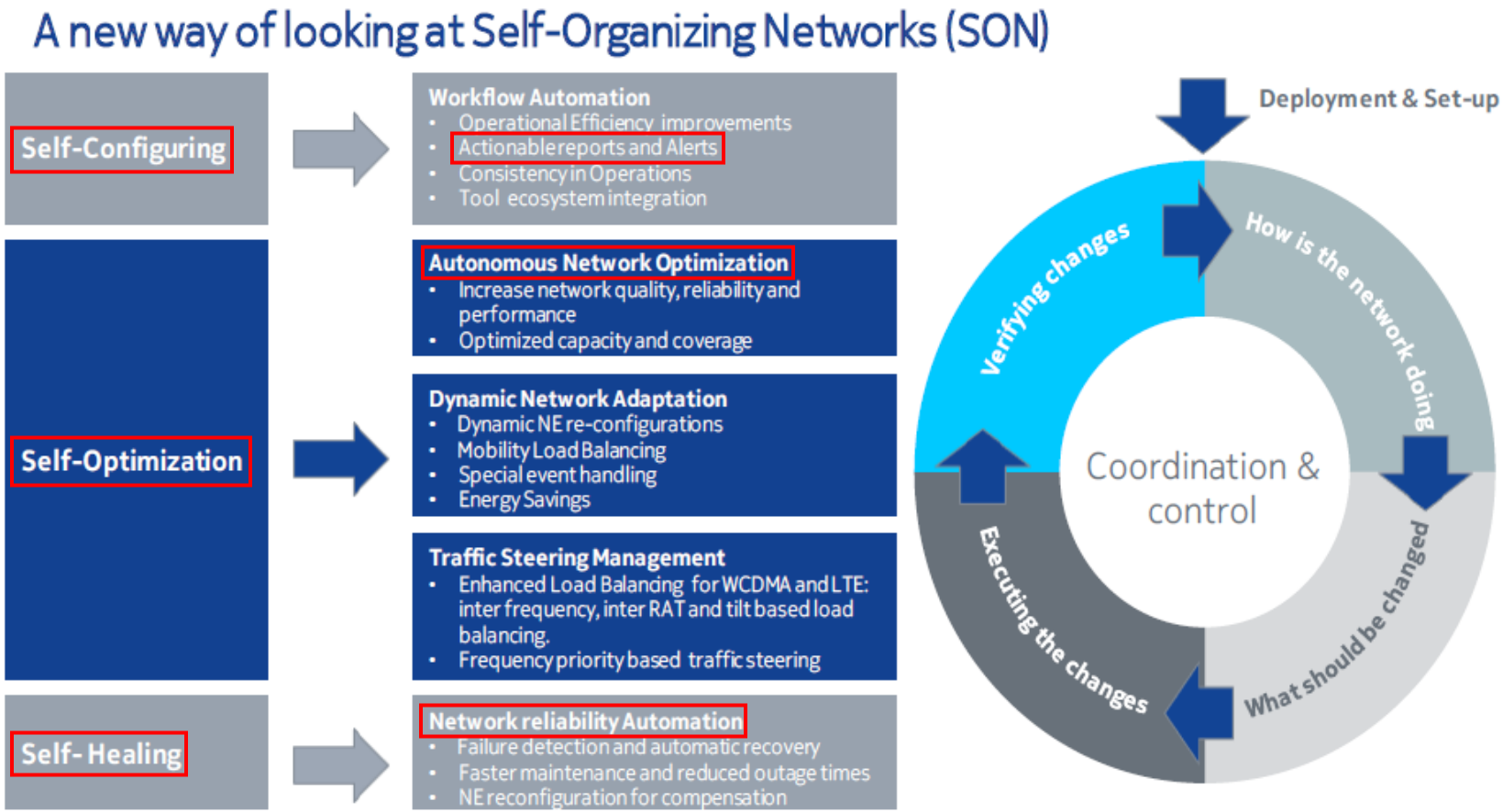


Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 20 & 21.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

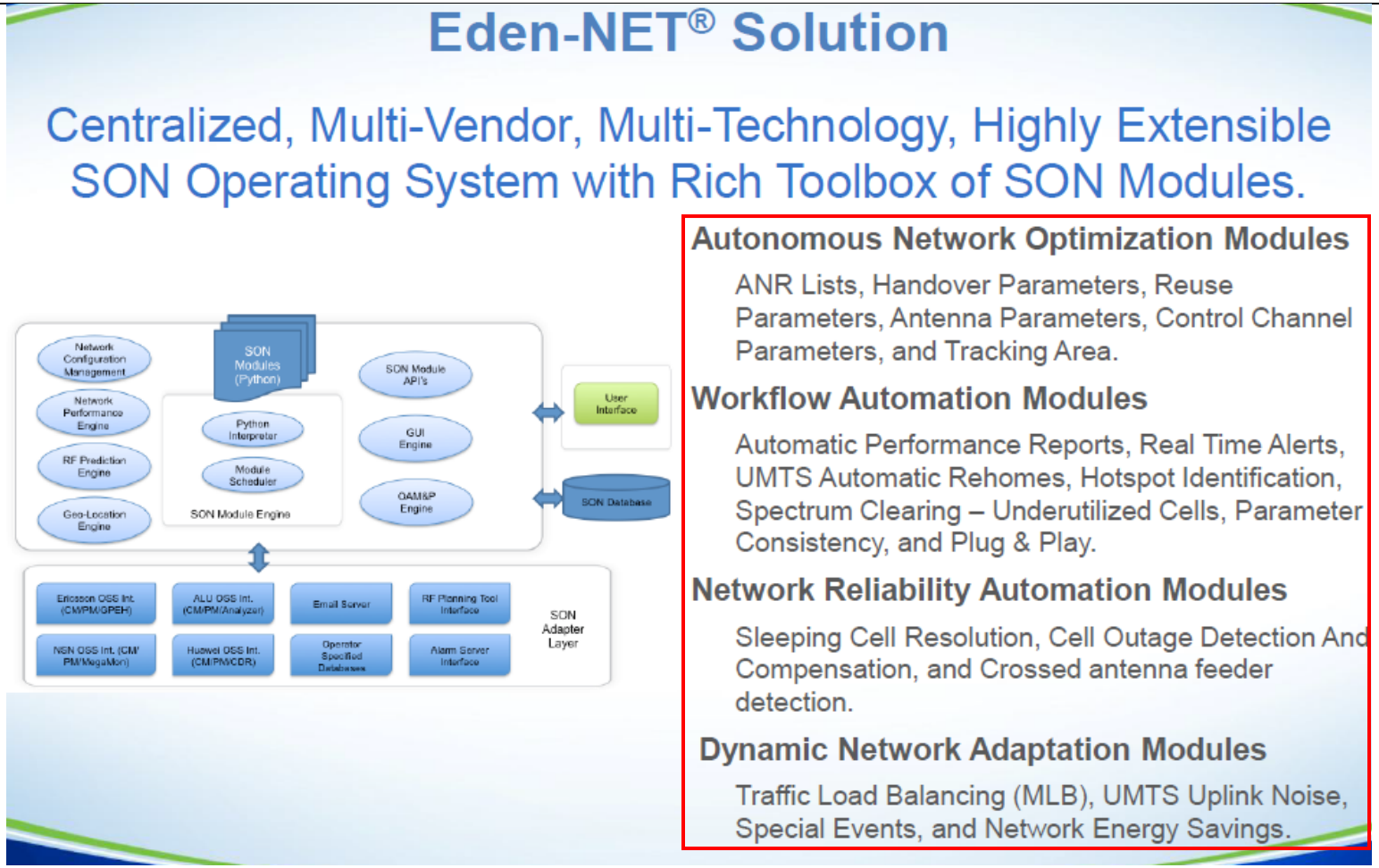
whereby the system of computers suggests the at least one corrective action in order to improve communication with the at least one of the at least two wireless devices,	Plaintiff contends that the system of computers a portion of which is executing or loaded with Nokia Eden-Net solution suggests the one or more corrective actions of the RF signals of the one or more radio-towers or base-stations in order to improve communication with one or more wireless devices. As already mentioned above, the system of computers can perform SON related functions. The system of computers optimizes the network by adjusting and fine-tuning network parameters such as antenna tilt, transmission power, etc. of the concerned radio-tower(s) or base-station(s) based on the RF information. These actions are suggested or performed by the system for improving communication with one or more wireless devices based on the error code. The following exemplifies this limitation's existence in Accused Systems:  **Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 24.**

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



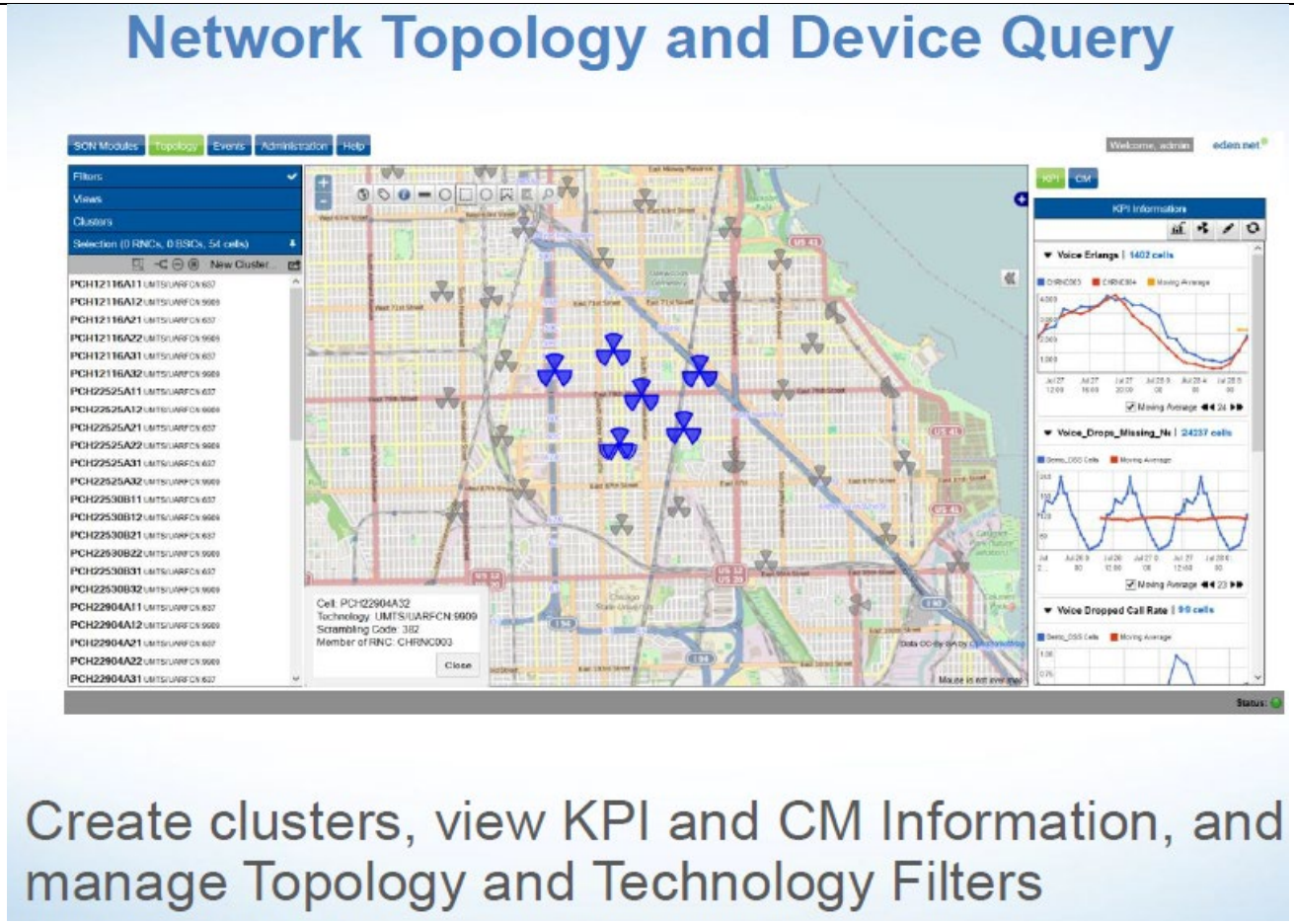
Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 6.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 41.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 49.

7 Monitoring SON events

SON events can be monitored under the **Events** tab.

…

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

7.1 Viewing events

To view events:

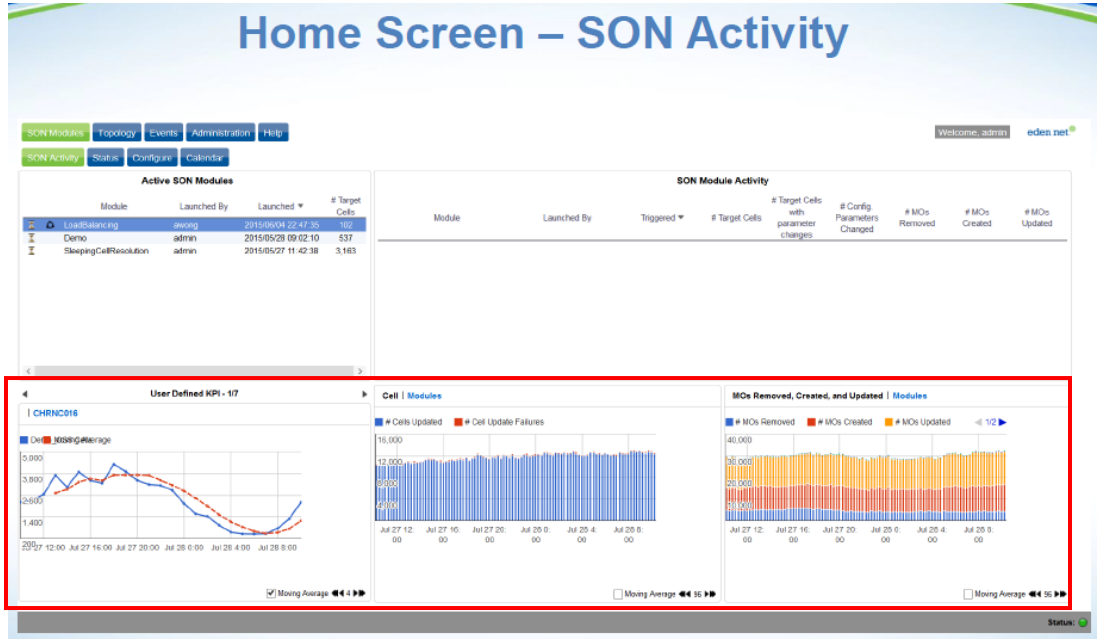
1. *Log in to the Eden-NET application.*
2. Click the **Events** tab.

Expected outcome

The **Events** screen appears, with data input fields and a table containing events.

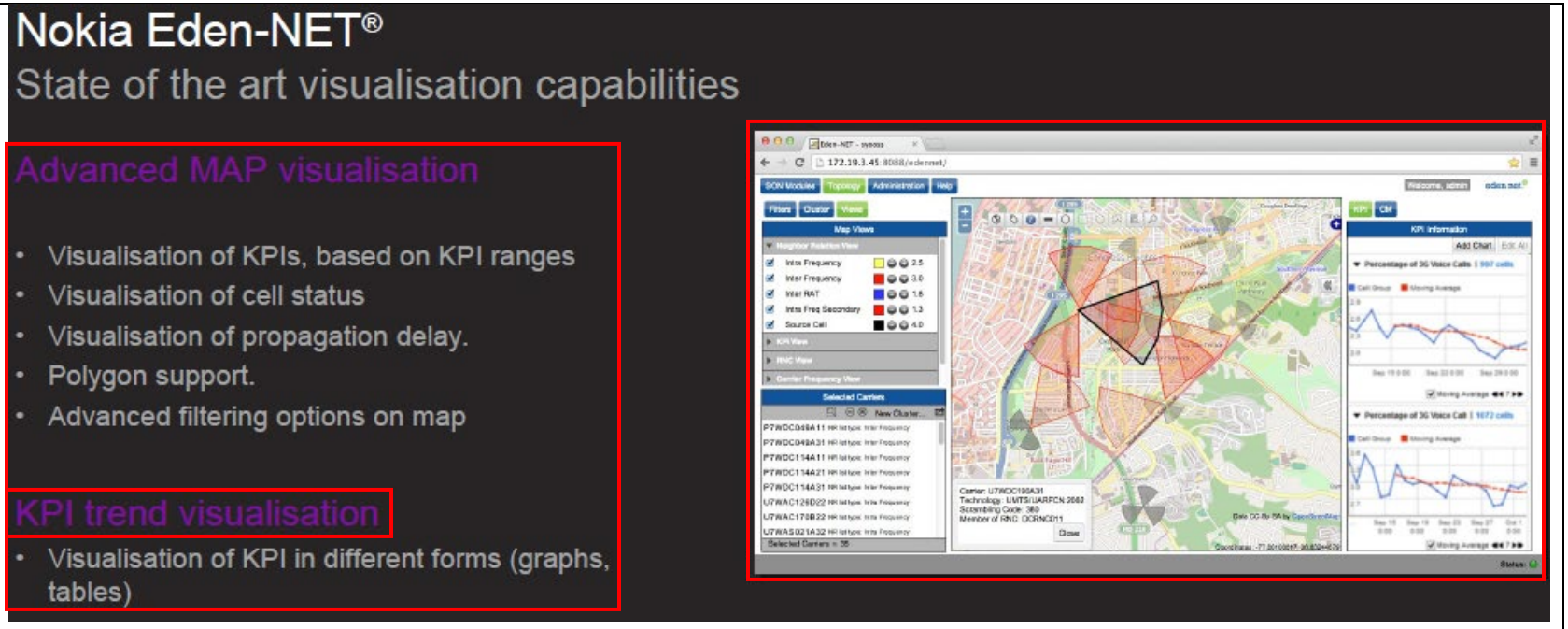
You can export the table to a CSV file by clicking the **Export table to CSV** icon at the bottom right-hand corner of the events table.

Attachment 12 (Eden-NET User Guide (2017)) at 71.



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 54.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 11 (Eden-Net with iSON Manager (2015)) at 12.

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U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Eden-NET® SON Modules

Deployed at Scale and Delivering the Industry's Best Results.

SON Module	2G	3G	4G
Automatic Performance Reports	↑	↑	↑
Real-Time Alerts	↑	↑	↑
Parameter Consistency Enforcement (PCE)	↑	↑	↑
Automatic Neighbor Relation (ANR)	↑	↑	↑
Layer Management Strategy (LMS)	↑	↑	↑
Reuse Code Optimization (RCO)	Q3	↑	↑
Coverage & Capacity Optimization (CCO)	N/A	↑	↑
Mobility Load Balancing (MLB)	N/A	↑	↑
Crossed Antenna Detection	↑	↑	↑
Plug & Play	N/A	↑	↑
Mobility Robustness Optimization (MRO)	N/A	Q1 '16	Q3
Sleeping Cell	N/A	↑	Q3
Automatic Parameter Optimization (APO)	Q4	Q4	Q4
Cell Outage Compensation	N/A	Q4	Q3
Special Event	Q4	Q4	Q4

SON Module	2G	3G	4G
Hotspot Identification	N/A	Q1 '16	Q1 '16
Enhanced Mobility Load Balancing (MLB)	N/A	Q1 '16	Q1 '16
Green Networks	Q1 '16	Q1 '16	Q1 '16
RACH Parameter Optimization	N/A	'16	Q4
Enhanced Plug & Play	N/A	N/A	Q1 '16
Spectrum Clearing	'16	N/A	N/A
Carrier Aggregation Optimization	N/A	N/A	'16
VoLTE Optimization	N/A	N/A	'16
Data Correlation	N/A	'16	'16
Tracking Area Optimization	N/A	N/A	'16
eICIC Optimization	N/A	N/A	'16
MIMO Optimization	N/A	N/A	'16
Uplink Noise Optimization	N/A	'16	N/A
CoMP Reporting	N/A	N/A	'16

NOKIA

Attachment 11 (Eden-Net with iSON Manager (2015)) at 7.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Autonomous Network Optimization Modules

Coverage and Capacity Optimization (CCO)

Overview:

- The Eden-NET LTE CCO module detects LTE cells that are overshooting and undershooting and apply corrective actions to mitigate this issue through either antenna tilts.
- By controlling the coverage footprint the module shall reduce interference and improve cell capacity.
- The CCO module identifies overshooting and the undershooting cells in the network.
- The CCO module will recommend down-tilting the over-shooters and up-tilting the under-shooters. These recommendations are implemented in an open-loop. In order for these recommendations to be actually implemented, the antennas to be up-tilted or down-tilted need to support RET.
- **Module :** CoverageCapacity / LTECCO
- **Supported vendors and technologies:** Nokia, Ericsson, Huawei, ALU (WCDMA, LTE), ZTE (WCDMA – limited support)

...

3G CCO:
The 3G CCO Module identifies which cells are under-shooters and over-shooters by analyzing the neighbor-directed handover attempts and successes, Detected Set Reporting (DSR), Call Trace Events, antenna location and azimuth information, and tilt score.
Then, this module proposes corrective actions for the most severely undershooting and overshooting cells. The corrective actions will be in-line with the configurable CCO policies, such as: max tilt adjustment, or power adjustment per iteration.
The up-tilt or down-tilt actions of the antenna beam will be either done as open-loop or closed-loop modes.
Finally, this module generates a report with all the changes performed during the closed-loop implementation. Closed-loop means that the configuration changes are actually implemented to the antenna with the help of RET after execution.

4G CCO: The 4G CCO module uses several handover, antenna, location, neighbor information data, and KPIs to detect under-shooting and over-shooting cells.
The CCO module will recommend down-tilting the over-shooters and up-tilting the under-shooters. These recommendations are to be implemented in open-loop or closed-loop. Open-loop means that the configurations will not be actually applied but just checked for consistency. The closed-loop implementation is actually performed on antennas that support RET.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 29.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Capacity and Coverage Optimization (CCO)

Nokia Eden-NET

Network challenge

- Optimal network settings are not possible to be reached only by planning
- Manual optimization requires huge effort in constantly changing multilayer network
- Bad behaving cells, such as overshooters, are hard to find manually and they have impacts on wider area
- Balancing between capacity and coverage

Solution

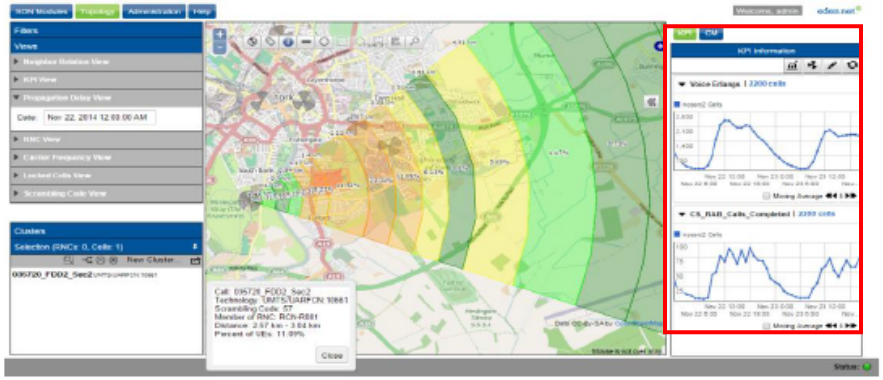
- CCO scans multiple radio access technologies and multiple radio access network vendors to detect coverage gaps, interference and overshooters
- CCO optimizes the coverage via advanced antenna and cell power adjustments

Value driver

- Identification of over-shooting and under-shooting cells to achieve performance gains

KPI Improvements

- 30% Call drop rates (improved voice quality and accessibility)
- 13% Handover success rate
- Average throughput (capacity and spectral efficiency)



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NOKIA

Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 19.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Mobility Load Balancing (MLB)

Nokia Eden-NET

Network challenge

- Part of the cells may be occasionally overloaded, causing access failures and dropped calls
- Ensuring network quality would require building extra capacity

Value driver

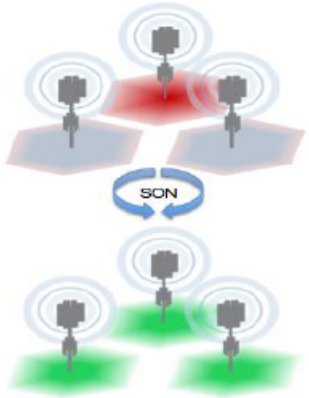
- 90% reduced manual operational efforts during cell congestion
- Maintaining network quality in case of peak load without need of extra capacity -> CAPEX savings

Solution

- MLB optimization triggers a redistribution of traffic from the overloaded cells to lightly loaded neighbor cells
- Results in
  - Evenly loaded network
  - Reduced voice and data dropped calls
  - Improved voice and data accessibility

KPI Improvements

- 12% Speech drop rate
- 16% Speech Setup success rate
- Traffic Volumes
- Channel utilization
- Traffic Latency
- Average per-user throughput



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 20.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Automatic Parameter Optimization

Nokia Eden-NET

Network challenge

- How to find optimal combination of parameters to reach desired KPI values

Solution

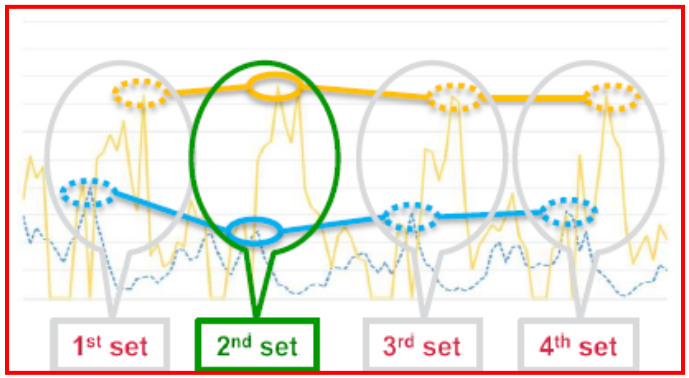
- Automatic Parameter Optimization finds optimal configurations by evaluating different parameter sets against performance metrics for multi vendor 2G, 3G and 4G networks.
- Supports rollback to the initial values, if needed
- Supports permanent pushing of optimal configuration into the
- WCDMA uplink noise optimization included

Value driver

- 90% OPEX reduction in customized configuration for new radio network features
- Faster rollout of new radio network features with optimal configuration

KPI Improvements

- Decreased call drop rate
- Handover success rate
- Average throughput



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 27.

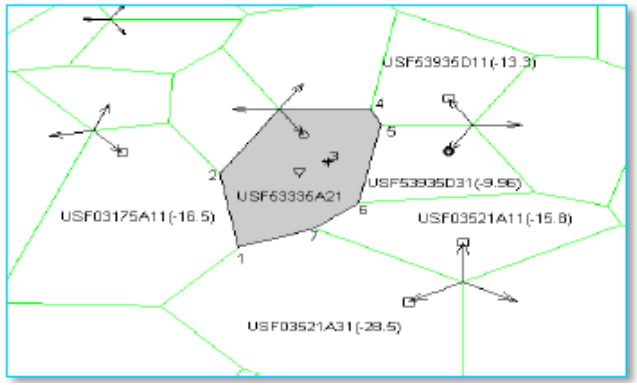
<table>
<tr>
<td></td>
<td>
Cell Outage Compensation
Nokia Eden-NET

Network challenge
• How to maintain coverage and capacity in case of a cell outage (when not recovered by Cell Outage Resolution)

Solution
• Examines the neighboring replacement cell(s)
  • KPIs to determine if a coverage gap has been caused as a result of the cell outage
  • which target cells' parameters can be adjusted without congestion when picking up the traffic
• Compensates by adjusting the electrical antenna tilt or transmission power to extend the coverage area
• Monitors the replacement cells to detect congestion and reverts the operation if needed

Value driver
• 90% reduction of manual efforts in detecting and compensating coverage gaps
• Ensure coverage

KPI Improvements
• Decreased call drop rate
• Handover success rate
• Average throughput

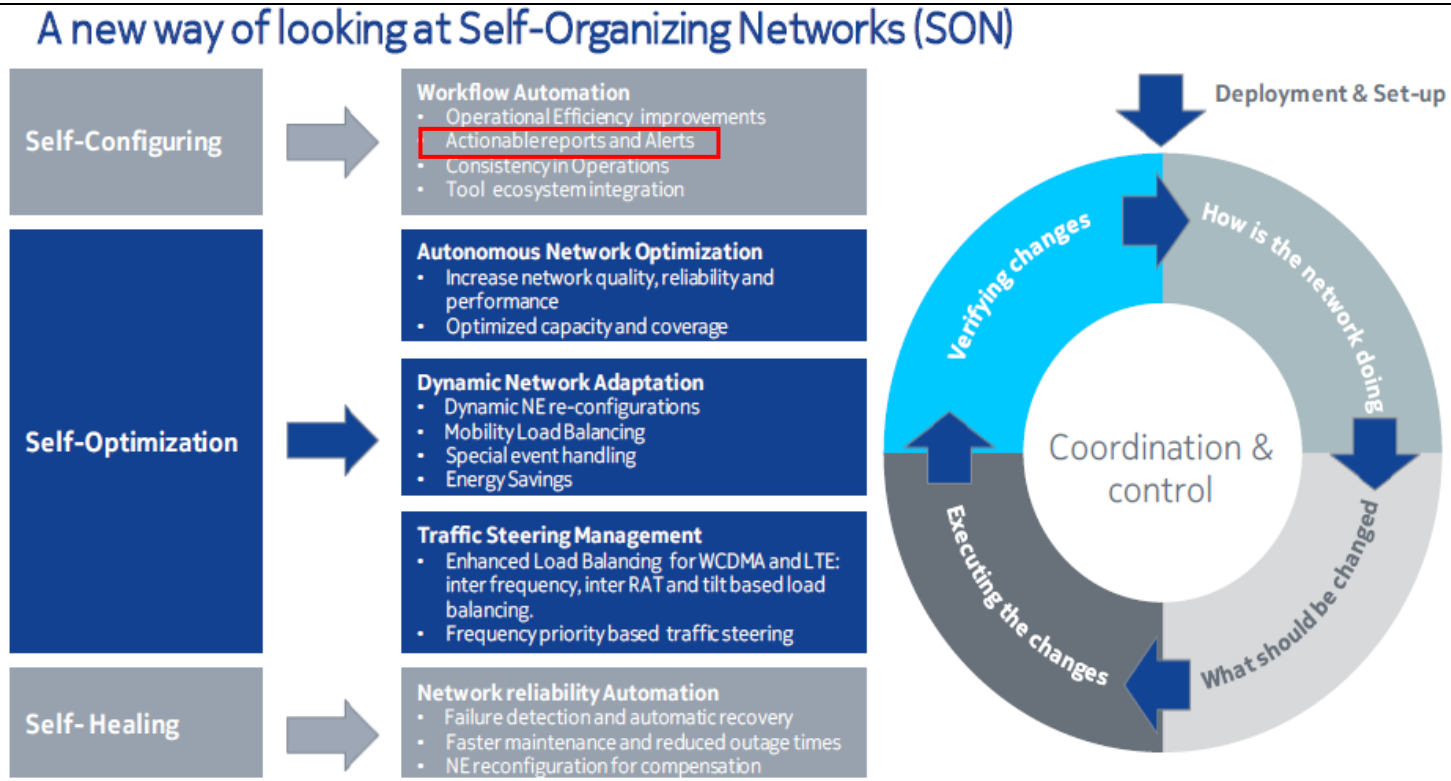


Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 29.
</td>
</tr>
<tr>
<td>and wherein the system of computers, responsive to</td>
<td>Plaintiff contends the system of computers a portion of which is executing or loaded with Nokia Eden-Net solution, for example, by using management functions such as Performance Management (PM), Fault Management (FM), Configuration Management (CM), etc. is capable of detecting communications errors or faults between the at least one mobile wireless communications device and the at least one RF transceiver in the form of alerts or alarms or notifications.</td>
</tr>
</table>

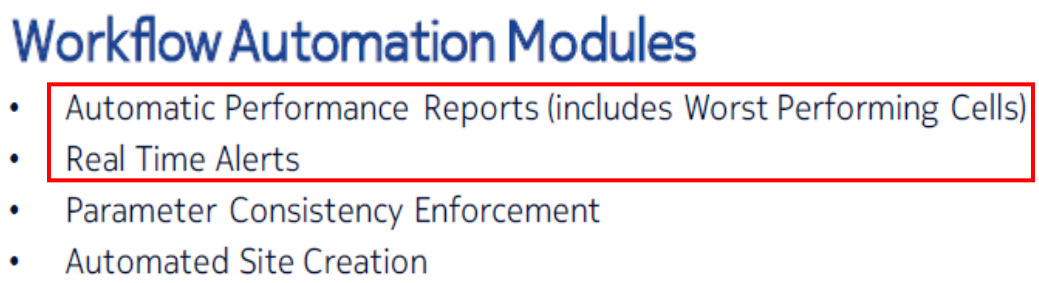
INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

detecting communications errors between the at least one of the at least two mobile wireless communications devices and the radio tower, generates case files that describe the communications errors, the radio tower, an indication of a location of the radio tower and parameters of communications between the at least one of the at least two mobile wireless communications devices and the radio tower over a time interval prior to a corresponding one of the communications errors and extending to the time of the	Plaintiff contends the system of computers a portion of which is executing or loaded with Nokia Eden-Net solution, for example, by using management functions such as Performance Management (PM), Fault Management (FM), Configuration Management (CM), etc. is capable of detecting communications errors or faults between the at least one of the at least two two mobile wireless communications device and the at least one RF transceiver/radio tower in the form of alerts or alarms or notifications. In response to detecting communications errors or faults, the system of computers generates case files or reports or logs that describe the communications errors, a corresponding one of the at least one RF transceiver, a location of the corresponding one of the at least one RF transceiver and parameters of communications between the at least one mobile wireless communications device over a time period before a corresponding one of the communications errors and extending to the time of the corresponding communications error. Plaintiff contends that a system of computers comprises wireless device location elements, including but not limited to one or more of position determination entities (PDE), mobile location/positioning centers, mobile switching center, location proxy servers, locations applications, location agents, GPS server, Wi-Fi server, home location register, visiting location register, one or more of which are used in locating a wireless device. The various location elements are T-Mobile components, T-Mobile subsidiaries or family of companies, vendors, partners and the like. The various location elements are meant to work across one or more of all technologies, including 2G, 3G, 4G, and 5G. The following exemplifies this limitation's existence in Accused Systems:

corresponding communications error.

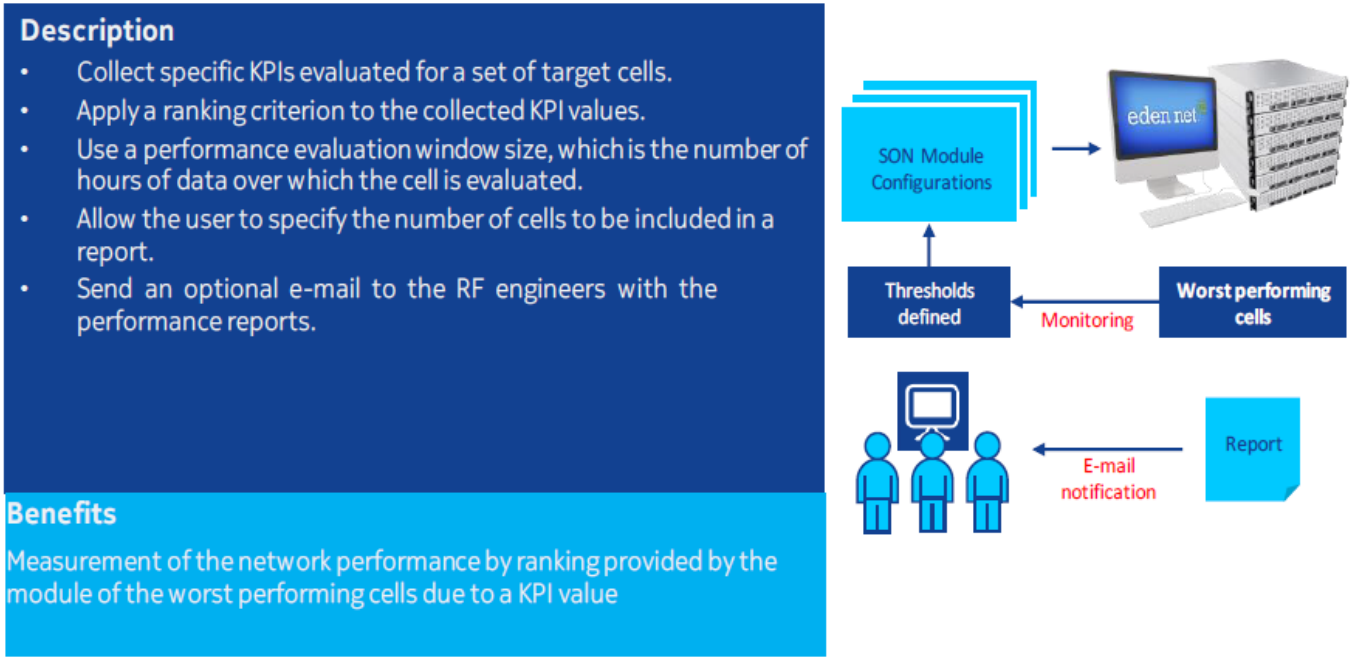


Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 6.



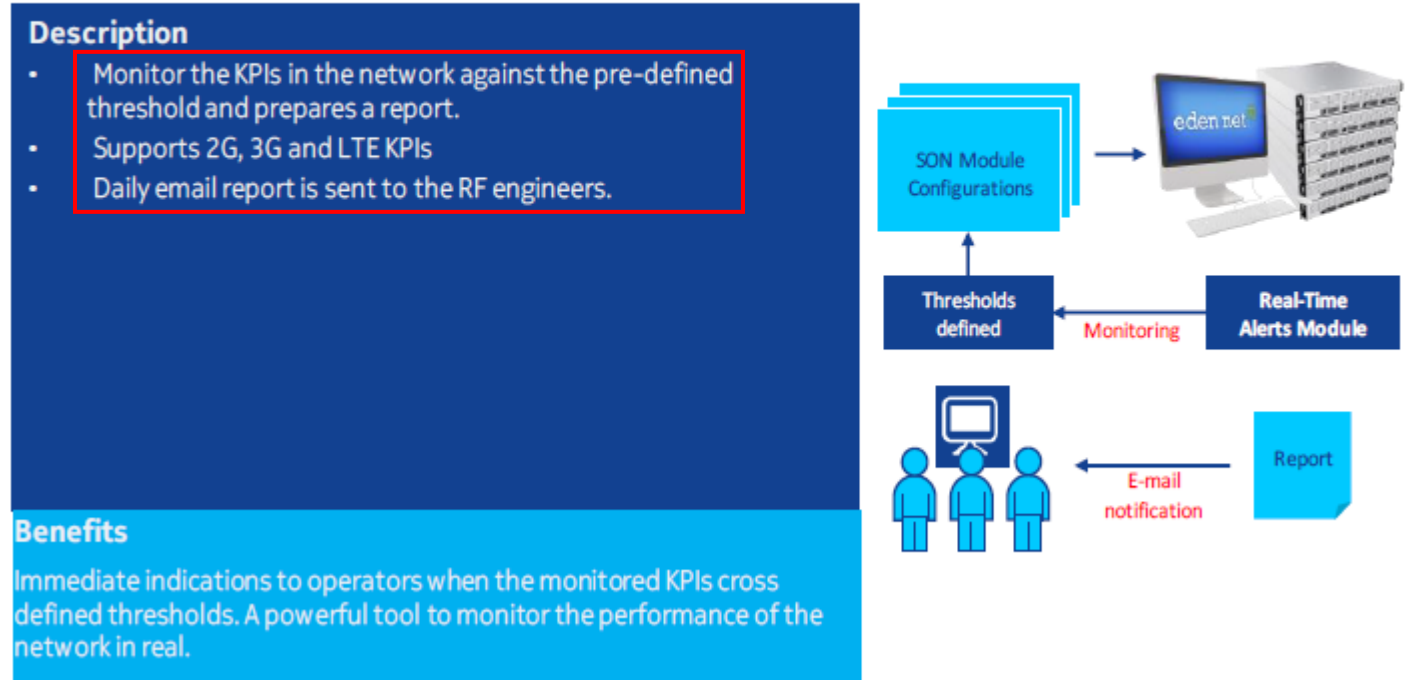
Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 48.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 50.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 52.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Real-Time Alerts

Nokia Eden-NET

Network challenge

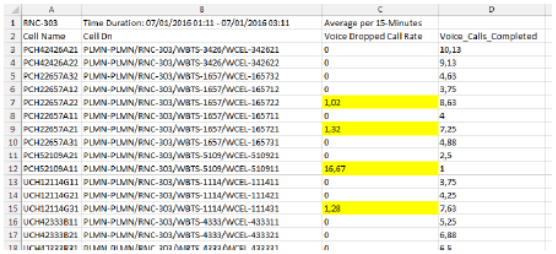
- How to find the degrading performance in the network

Solution

- Eden-NET monitors in real-time a more limited set of KPIs than the Automatic Performance Reports module
- Generates alarms and sends an email to the responsible RF engineer if the KPIs exceed pre-defined or learned thresholds.

Value driver

- Reduced response times to network issues, improved network reliability and a reduction in dropped calls, access failures



	A	B	C	D
1	RNC-303	Time Duration: 07/01/2016 01:11 - 07/01/2016 03:11	Average per 15-Minutes	
2	Cell Name	Cell Dn	Voice Dropped Call Rate	Voice_Calls_Completed
3	PCH42426A21	PLMN-PLMN/RNC-303/WBTS-3426/WCEL-342621	0	10,13
4	PCH42426A22	PLMN-PLMN/RNC-303/WBTS-3426/WCEL-342622	0	9,13
5	PCH22657A32	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165732	0	4,63
6	PCH22657A12	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165712	0	3,75
7	PCH22657A22	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165722	1,02	8,63
8	PCH22657A11	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165711	0	4
9	PCH22657A21	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165721	1,32	7,25
10	PCH22657A31	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165731	0	4,88
11	PCH52109A21	PLMN-PLMN/RNC-303/WBTS-5109/WCEL-510921	0	2,5
12	PCH52109A11	PLMN-PLMN/RNC-303/WBTS-5109/WCEL-510911	16,67	1
13	UCH12114G11	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111411	0	3,75
14	UCH12114G21	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111421	0	4,25
15	UCH12114G31	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111431	1,28	7,63
16	UCH42333B11	PLMN-PLMN/RNC-303/WBTS-4333/WCEL-433311	0	5,25
17	UCH42333B21	PLMN-PLMN/RNC-303/WBTS-4333/WCEL-433321	0	6,88

Automatic Performance Reports

Nokia Eden-NET

Network challenge

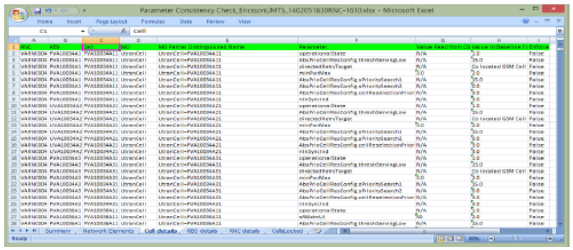
- How to find the worst performing cells in the network

Solution

- Eden-NET processes and analyzes continuously large volumes of performance data across each of the 2G, 3G, and 4G cell e.g.
  - Accessibility KPIs
  - Retainability KPI's
  - Throughput KPI's.
- Identifies the poorest performing cells
- Sends reports to RF Engineers

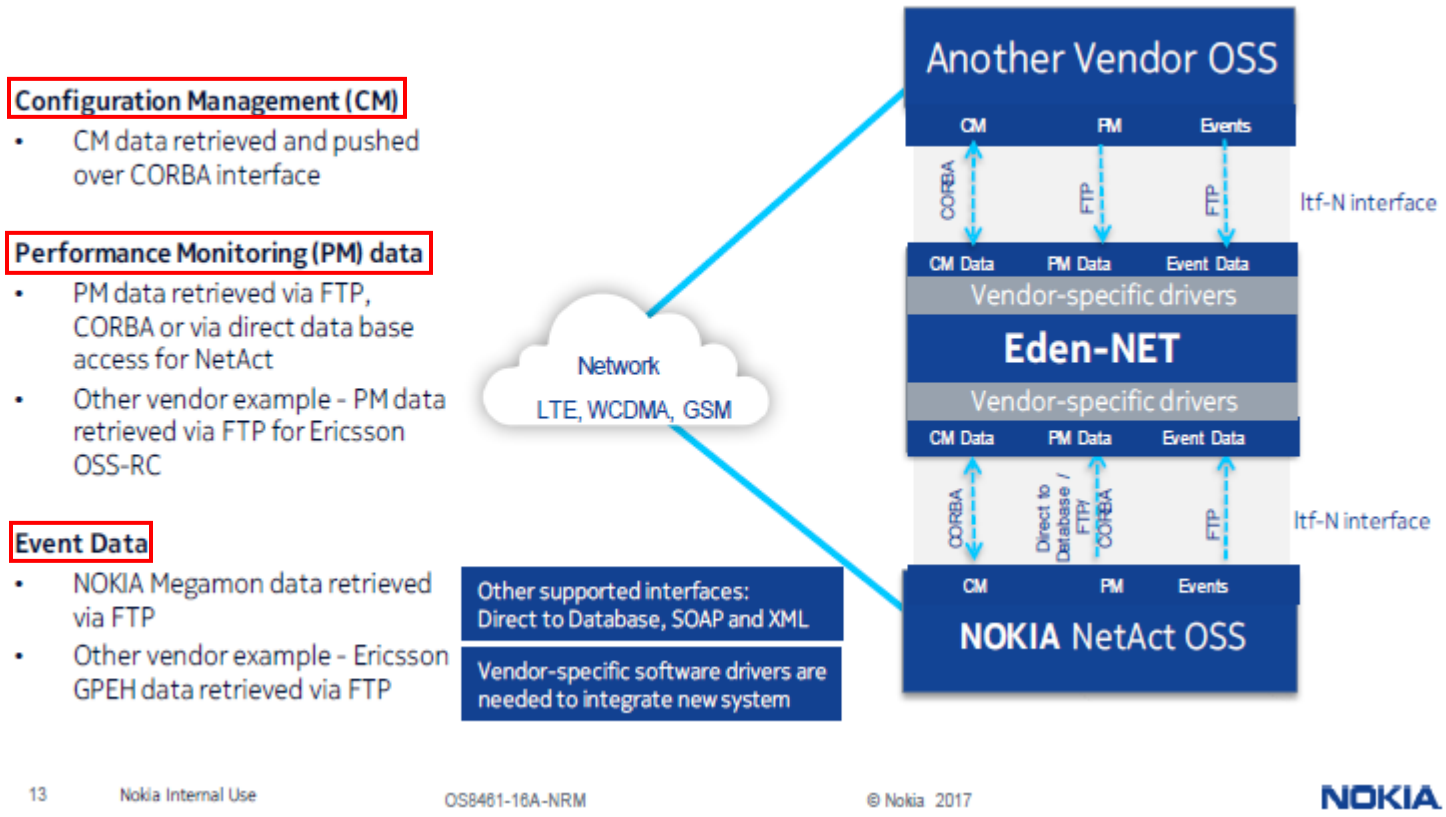
Value driver

- Reduction in manual operational efforts in finding the poor performing network resources



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 25.

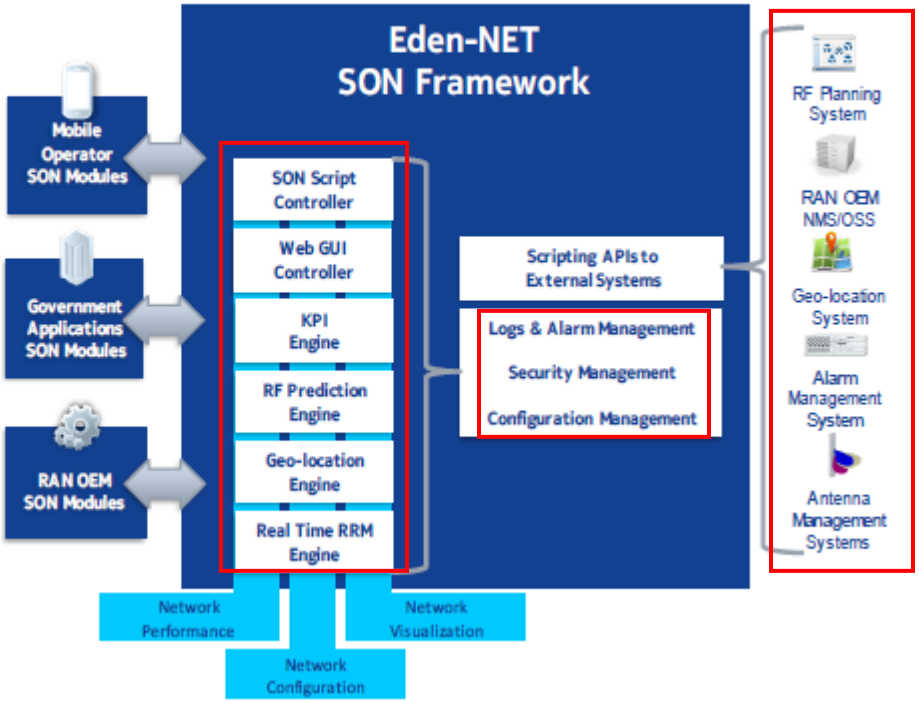
INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 12.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

SON Framework



…

The SON Framework serves the function of operating system for SON that makes easy to the Operators to manage and enable the individual SON modules. The SON Framework interacts with external systems such as OSS/NMS systems, antenna management systems, RF Planning systems, and Alarm Management systems. The scripting framework includes software API's to interface with these external systems.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 11.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

NGMN Ref #	Use Case
Planning Related Use Cases	
[P01]	Base Station Location Planning
[P02]	Base Station Hardware Planning
[P03]	Automatic Generation of Radio Parameters
[P04]	Planning of transport parameters of a new Base Station
[P05]	Planning of security Node, Access GW and Operations and Maintenance Center
Deployment Use Cases	
[D01]	Hardware Installation
[D02]	Network authentication
[D03]	Software Installation
[D04]	Transport Parameter Setup
[D05]	Radio Parameter Setup
[D06]	Testing (Built in Diagnostic/Self Tests)
Optimization Use Cases	
[O01]	Radio Parameter Optimization: Neighbor cell list optimization
[O02]	Radio Parameter Optimization: Interference Control
[O03]	Radio Parameter Optimization: HO parameterization optimization
[O04]	Radio Parameter Optimization: QoS related parameter optimization
[O05]	Radio Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O06]	Transport Parameter Optimization: Routing Optimization
[O07]	Transport Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O08]	Reduction of Energy Consumption
[ERO01]	Capacity Optimization (Congestion Prime)
Maintenance Use Cases	
[Ops01]	Hardware / Capacity extension (Easy plug and play hardware replacement)
[Ops02]	Autonomous Inventory
[Ops03]	Automatic SW Download to Base Station
[Ops04]	Automated NEM upgrade
[Ops05]	Cell outage detection
[Ops06]	Performance Management in real time
[Ops07]	Direct KPI reporting in real time
[Ops08]	Information Correlation for Fault Management
[Ops09]	Subscriber and Equipment trace
[Ops10]	Cell Outage Compensation
[Ops11]	Compensation for Outage of higher level network elements (ASN GW)
[Ops12]	Fast recovery on instable NEM system
[Ops13]	Mitigation of outage of units
[EROps01]	System Availability

Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 10.

5.3 LTE1049: MDT - UE Measurement Logs

5.3.1 Description of LTE1049: MDT - UE Measurement Logs

Introduction to the feature

The *LTE1049: MDT - UE Measurement Logs* feature allows the eNodeB to support the configuration and retrieval of user equipment (UE) measurement logs as well as to report those with a cell trace.

...

operators. A minimization of drive tests (MDT) has been proposed in order to meet operator requirements. It is a method of collecting the DT data directly from regular UEs used in the network; it is a less expensive approach to DTs. There are two modes of MDT measurements:

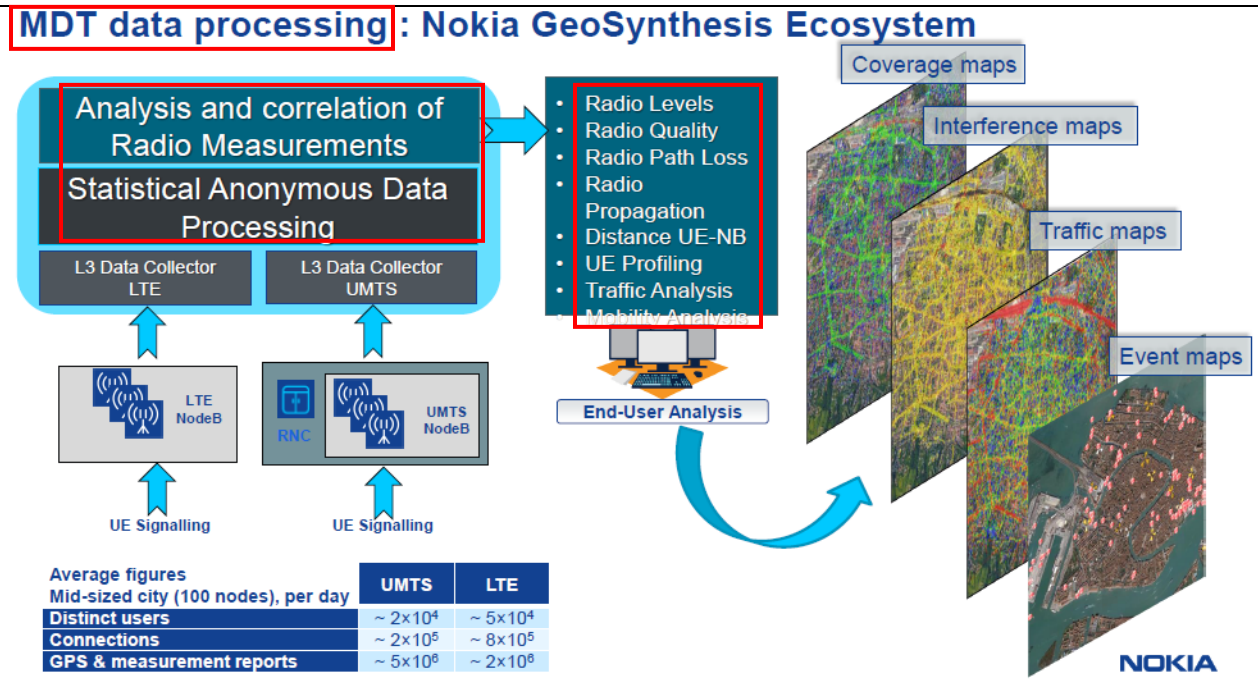
...

The UE measurement logs contain the following information:

- location info (global navigation satellite system (GNSS) information is optional for the UE)
- time stamp
- serving cell ID
- serving cell measurements
- neighbor cell measurements

Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 308 and 309.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 7.

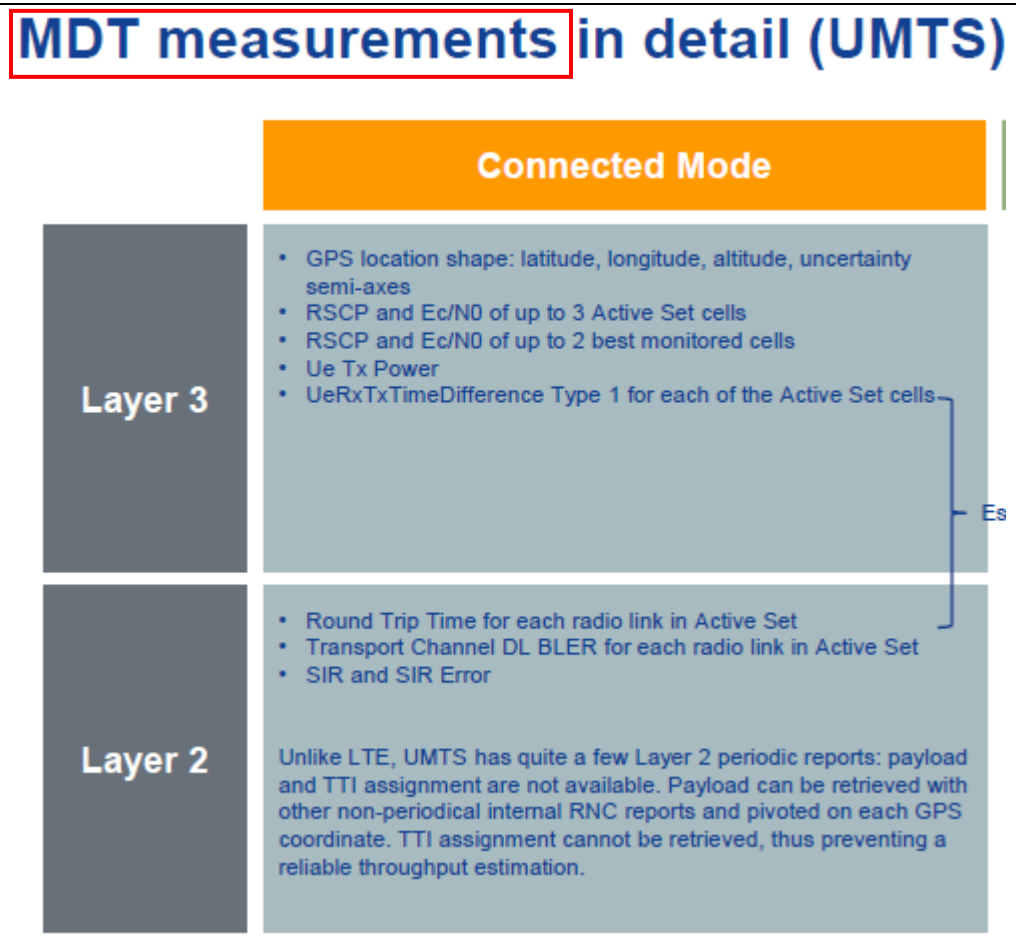
The LTE CCO continually assesses the impact of network changes based on network KPIs. It verifies that the implemented changes are having a positive impact on the network by monitoring specific KPIs. These KPIs are selected from the following areas:

- LTE accessibility, retainability, traffic, IRAT volumes, physical resource block utilization and channel quality indicator distributions
- WCDMA accessibility, retainability, traffic, IRAT leakage and handover volumes
- GSM accessibility, retainability, traffic, and handover

If the module detects that KPIs are degrading after a parameter change has been applied, then the module rolls back the parameters to their previous settings and blacklists the cells.

Attachment 15 (LTE Coverage and Capacity Optimization Guide (2017)) at 8.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



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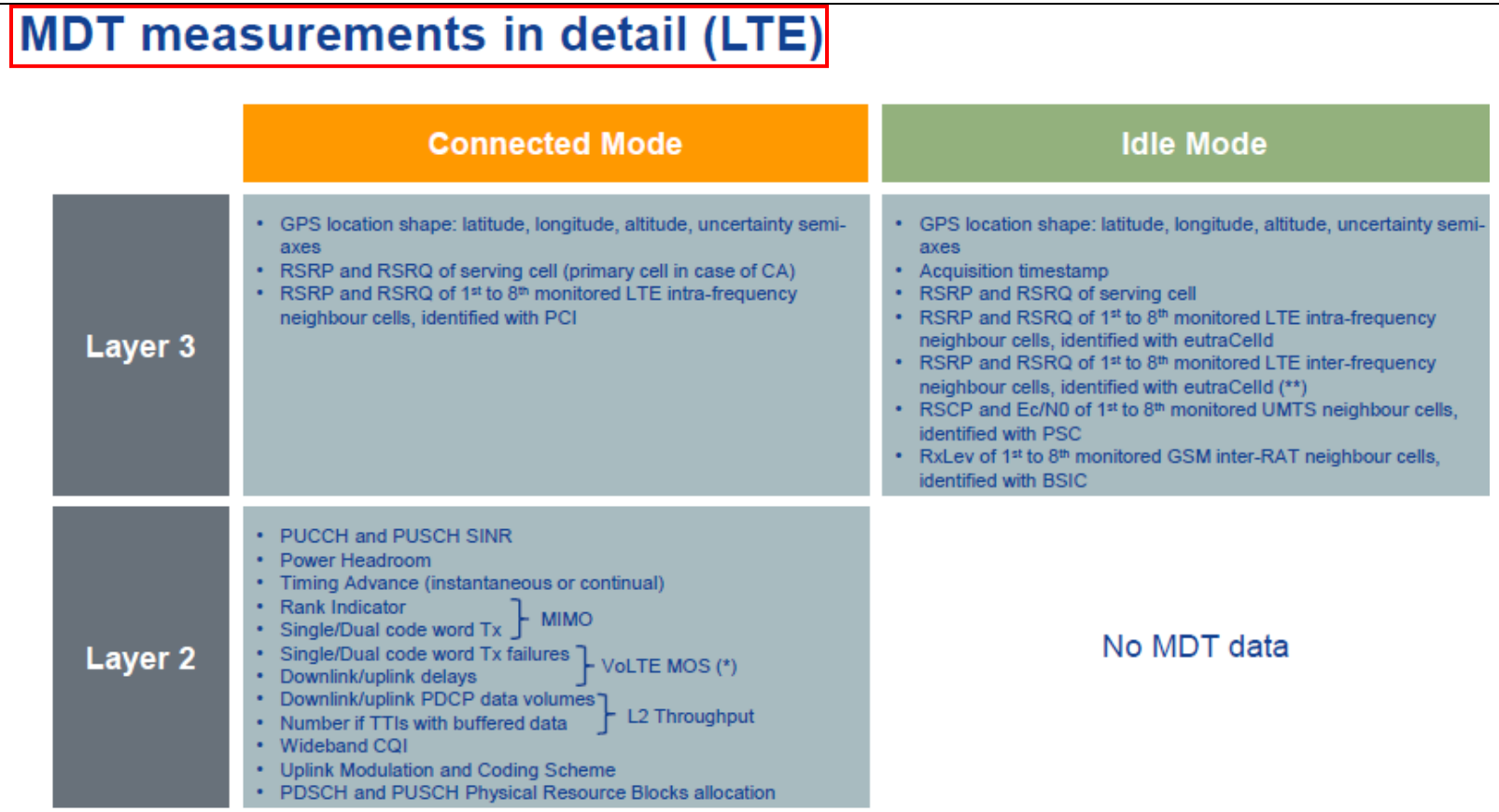

Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 9 and 10.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Eden-NET® SON Modules

Deployed at Scale and Delivering the Industry's Best Results.

SON Module	2G	3G	4G
Automatic Performance Reports	↑	↑	↑
Real-Time Alerts	↑	↑	↑
Parameter Consistency Enforcement (PCE)	↑	↑	↑
Automatic Neighbor Relation (ANR)	↑	↑	↑
Layer Management Strategy (LMS)	↑	↑	↑
Reuse Code Optimization (RCO)	Q3	↑	↑
Coverage & Capacity Optimization (CCO)	N/A	↑	↑
Mobility Load Balancing (MLB)	N/A	↑	↑
Crossed Antenna Detection	↑	↑	↑
Plug & Play	N/A	↑	↑
Mobility Robustness Optimization (MRO)	N/A	Q1 '16	Q3
Sleeping Cell	N/A	↑	Q3
Automatic Parameter Optimization (APO)	Q4	Q4	Q4
Cell Outage Compensation	N/A	Q4	Q3
Special Event	Q4	Q4	Q4

SON Module	2G	3G	4G
Hotspot Identification	N/A	Q1 '16	Q1 '16
Enhanced Mobility Load Balancing (MLB)	N/A	Q1 '16	Q1 '16
Green Networks	Q1 '16	Q1 '16	Q1 '16
RACH Parameter Optimization	N/A	'16	Q4
Enhanced Plug & Play	N/A	N/A	Q1 '16
Spectrum Clearing	'16	N/A	N/A
Carrier Aggregation Optimization	N/A	N/A	'16
VoLTE Optimization	N/A	N/A	'16
Data Correlation	N/A	'16	'16
Tracking Area Optimization	N/A	N/A	'16
eICIC Optimization	N/A	N/A	'16
MIMO Optimization	N/A	N/A	'16
Uplink Noise Optimization	N/A	'16	N/A
CoMP Reporting	N/A	N/A	'16

NOKIA

Attachment 11 (Eden-Net with iSON Manager (2015)) at 7.

Information We Collect Automatically

We automatically collect a variety of information associated with your use of your device (on our network, when roaming, or in WiFi mode) and our products and services, some of which may be associated with you or another user on your account.

…

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U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

For example some of the ways we may automatically collect information include:

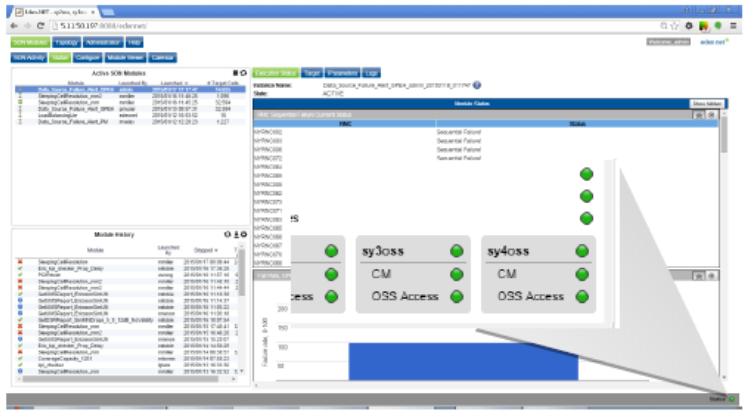
- Our systems capture details about the type and location of wireless device(s) you use, when the device is turned on, calls and text messages you send and receive (but we do not retain the content of those calls or messages after delivery), and other data services you use.
- We may also gather information about the performance of your device and our network. Some examples of the types of data collected include: the applications on the device, signal strength, dropped calls, data failures, and other device or network performance issues.

Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 6.

Nokia Eden-NET

- IT System Integrations.

IT System	Availability
PM	↑
CM	↑
Call Trace	↑
Subscriber Geolocation	Q4 '15
FM	Q3 '15
Big Data Systems	'16
Trouble Ticket and Work Order Systems	'16
Inventory management systems	'16
MME OSS: PM, CM Integration	'16
CEM	'16
Drive Test and 3rd Party Probe	'17



The SON Adapter Layer provides a well-structured extensible abstraction layer for interfacing with external systems.

Attachment 11 (Eden-Net with iSON Manager (2015)) at 9.

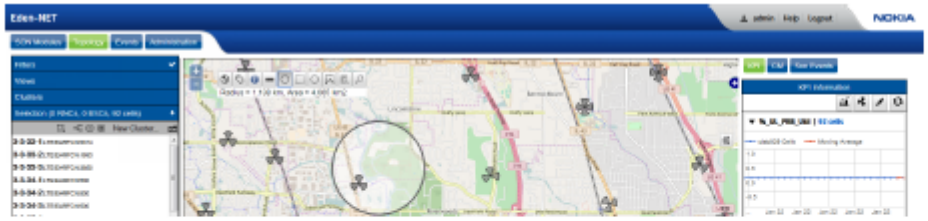
Eden-NET provides users the capability to visualize geographic relationships between targeted network cells. These visualizations and targets are managed via Eden-NET's extensive visualization screens, which support multiple radio access technologies and allow users to quickly receive feedback regarding SON actions applied to network elements.

The contents of this guide develop one's understanding of the functionality and features found throughout Eden-NET and introduce key areas of understanding, including:

- Management of user accounts
- Interacting with network topology maps and network elements
- Configuring and monitoring SON Modules for execution
- Retrieving output files and log reports
- Understanding SON history and status screens
- Defining topology
- Tracking network performance with KPI charts
- Using administrative functions such as Rollback, importing modules, exclusion or inclusion of lists, and configuring account privileges
- Using different map controls
- Managing KPI charts
- Viewing SON events
- Using Automated Site Creation functionality

Attachment 12 (Eden-NET User Guide (2017)) at 7.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Map scale and Lat/Long

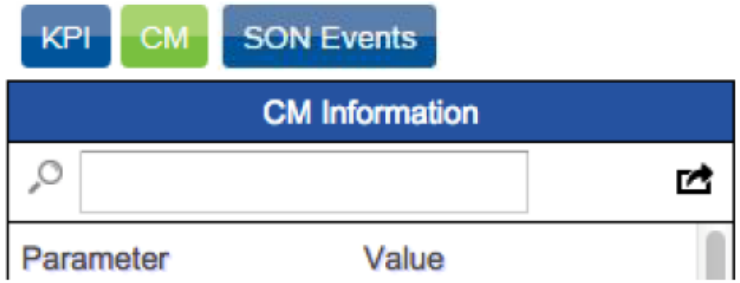
The map's reference scale and geographical Lat/Long coordinates are located on the bottom left and bottom right of the map, respectively.

6.10.3 Cell Information

Eden-NET provides multiple ways to view cell and network information. These include:

CM Information

The CM Information window is found under the same set of tabs as the KPI Information window under **Topology**.

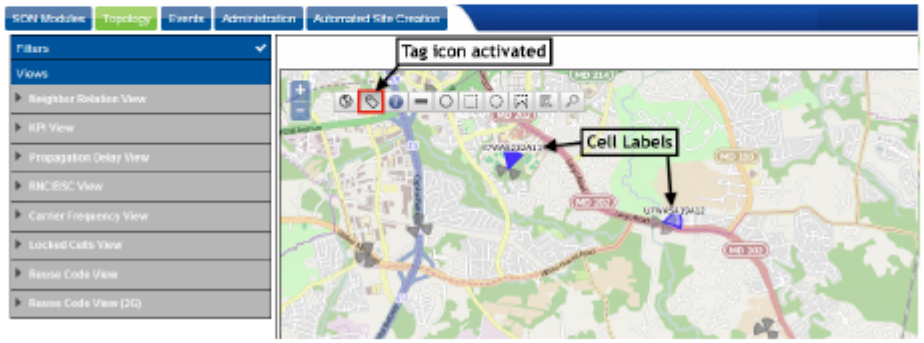


This window provides configuration information for network elements. Select a cell to view its CM information. Cell selection for this purpose can be achieved using the map, the Selection list, or the CM Information text box search tool. The icon allows for the CM Information to either be opened in a new window or exported to CSV.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Cell Labels

The tag icon , located in the map toolbar, activates cell ID labels.



Cell Information Window

The information icon , located in the map toolbar, opens the Cell Information Window when activated. This information window is located in the bottom left corner of the map. To view a cell's information in this window, hover over the cell on the map. Information provided in this window includes:

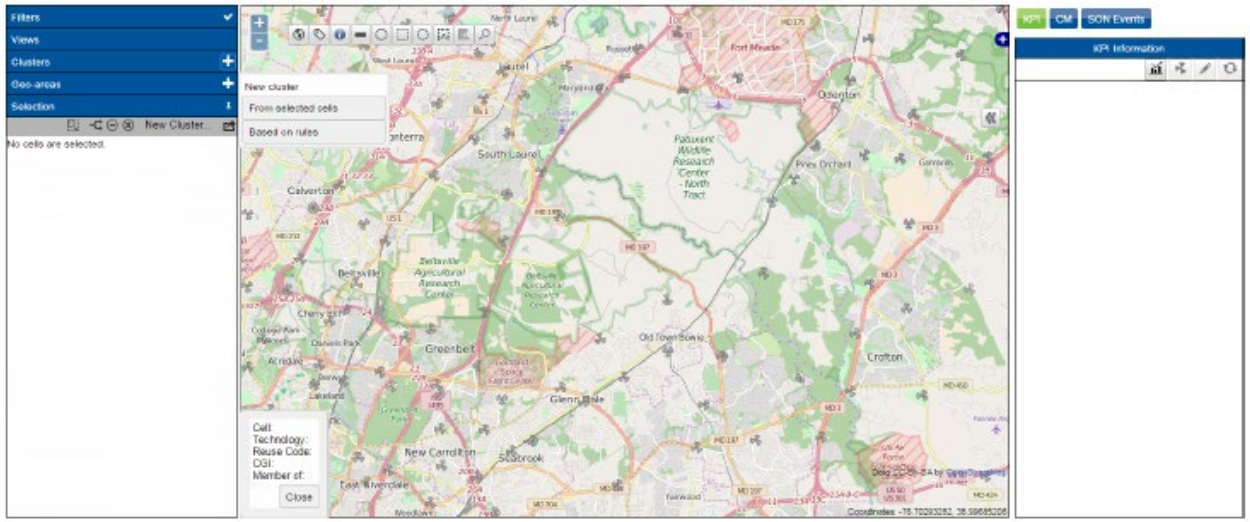
- Cell ID
- Technology (2G, 3G, 4G – Frequency)
- Scrambling Code/PCI Code
- CGI (Cell Global ID)
- Member of RNC/BSC

Attachment 12 (Eden-NET User Guide (2017)) at 69 and 70.

6.5 Select Cells

This section provides methods for making cell selections in Eden-NET.

In order to configure and execute **SON Modules** in Eden-NET, cells must first be selected and added to the **Selection** list which displays the number of RNCs/BSCs selected and the number of cells selected, as highlighted below.

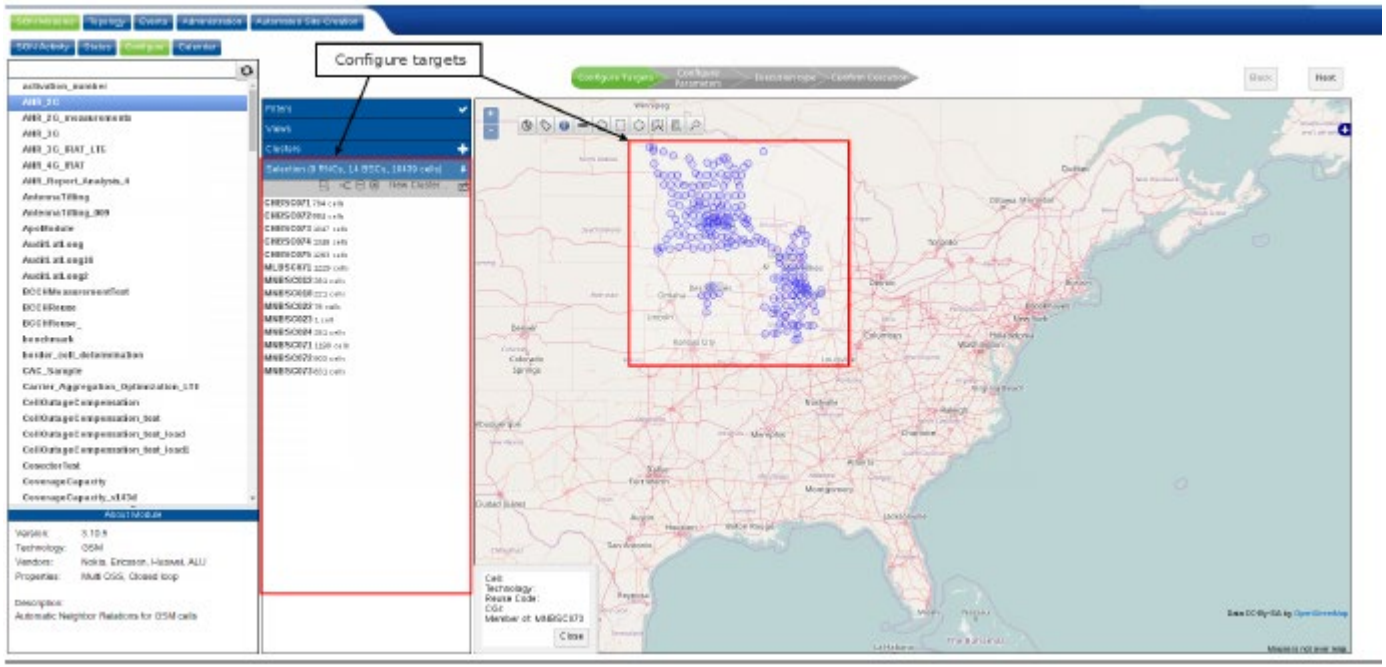


Attachment 12 (Eden-NET User Guide (2017)) at 53 and 54.

5.3.1 Configuring targets

Select targets for configuration by using one of Eden-NET's methods for selection of cells. Methods include using map-based or cell name search selection tools from the map toolbar, using existing clusters that have been created, and using Eden-NET's capability for vendor and/or controller (RNC/BSC) selection. When the SON Module and the target cells are selected, click **Next**.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 12 (Eden-NET User Guide (2017)) at 28.

5.1.3 Creating SON Module KPI chart

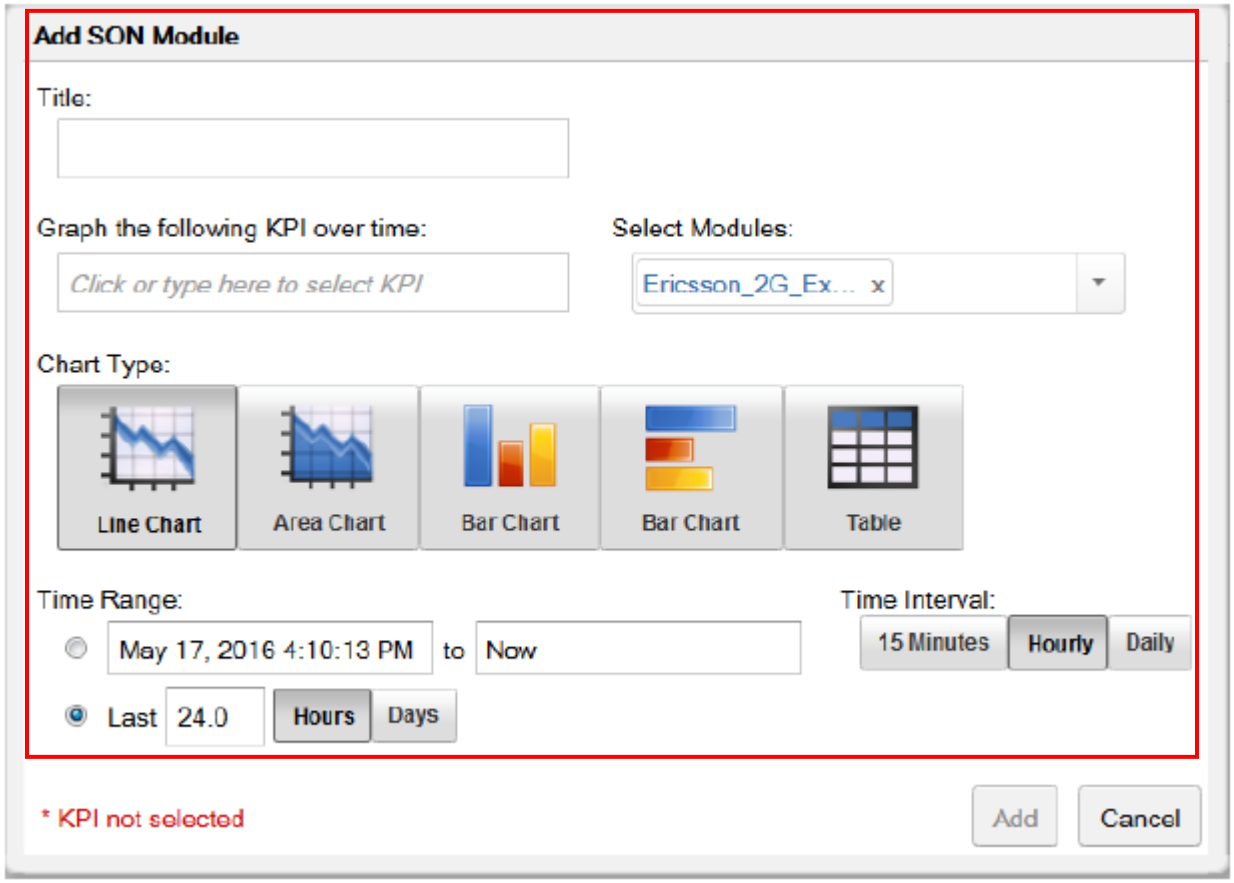
This screen displays the KPI chart for module level KPIs. These charts display the SON KPI information aggregated for all instances of the same module type, for example, a SON KPI chart for ANR MO additions shows MO additions for all module instances of ANR.

…

4. In **SON KPI Charts** tab, click the **Chart**  icon.

   The **Add SON Module** dialog box appears.

INFRINGEMENT CONTENTIONS
U.S. PATENT APP. NO. 11,445,328 – CLAIM 1



Attachment 12 (Eden-NET User Guide (2017)) at 16 and 17.

5.1.4 Viewing user defined KPI charts

The User Defined KPI window of the **SON Activity** screen houses charts that graphically represent various Key Performance Indicators. To view charts:

…

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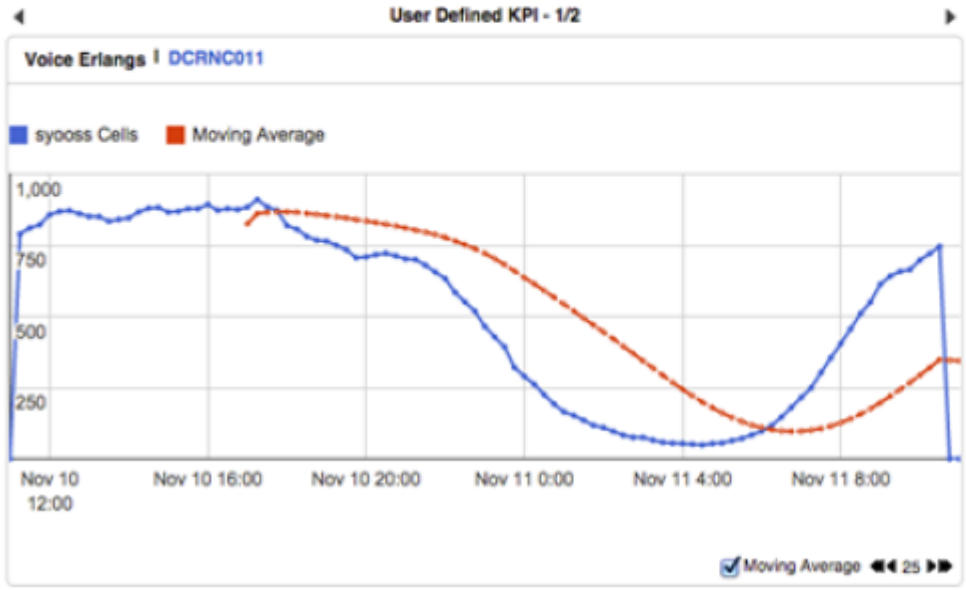
User Defined KPI charts are visible below the **SON Module Activity** area.

These charts are user-defined and are configured under the **Topology** tab. Once created, KPI charts can be sent to the home screen for easier accessibility of information.



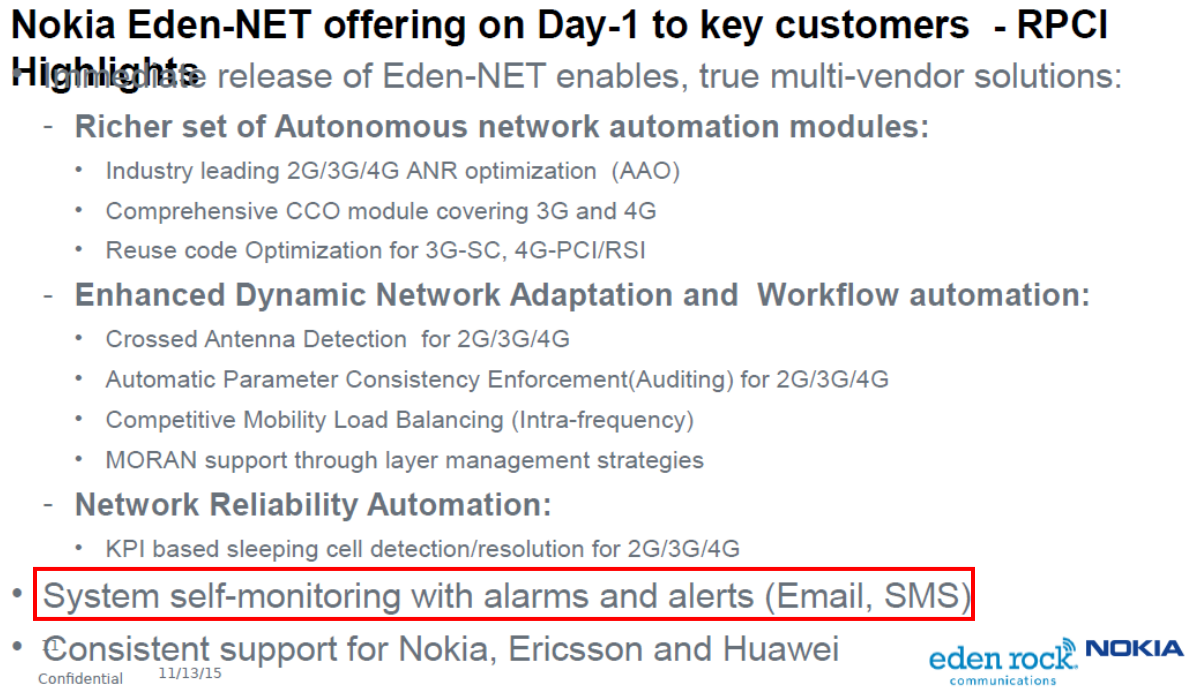
Attachment 12 (Eden-NET User Guide (2017)) at 18.

6.2.2 KPI View

The KPI View provides the capability to visually represent cells on the map based on their performance record. For example, a user can configure this view to display cells with a high number of dropped calls as red and cells with a low number as green.

- KPI for configuration
- Date of data (default is Most Recent)
- Resolution (default is Hourly)
- Define the thresholds for the KPIs.

Attachment 12 (Eden-NET User Guide (2017)) at 36.



Attachment 11 (Eden-Net with iSON Manager (2015)) at 11.

INFRINGEMENT CONTENTIONS
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Nokia Eden-NET grows stronger during Q3-Q4, 2015 - RPCI Highlights

- Multi-vendor LTE RAN integration
- LTE MRO
- Cell Outage Compensation (COC) – KPI based
- Reuse code Optimization for 2G-BCCH
- Alarm based cell outage detection and resolution
- Further ANR Optimization
- Geo-enhanced versions of CCO for 3G and 4G
- First release (**Eden-NET 16EA**) with iSON Manager ported functionality, enabling:
  - Small Cell support
  - Automated Site Creation for WCDMA, LTE, small cells and SingleRAN
  - SON coordinator: Collision avoidance, Auto-verification and Rollback
  - PCI enhancements
  - Inter-RAT MRO

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Attachment 11 (Eden-Net with iSON Manager (2015)) at 13.

4.3.3 SON Module Manager

SON Module Managers are granted all the privileges of SON Module Executor and SON Monitor users. These privileges include:

- Stopping SON Modules

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- Configuring, running, and scheduling future SON Module executions
- Viewing the content of SON Modules (when available)
- Retrieving and analyzing SON Module output performance reports
- Viewing and analyzing network performance metrics

Additional privileges granted to SON Module Managers are related to the management of available SON Modules and SON priorities. Specifically, these include:

- Setting both user and module priorities
- Managing advanced SON Module configuration
- Configuring SON Module default parameter values
- Configuring SON Exclusion List
- Configuring Black and White Lists
- Executing Network Rollback

Attachment 12 (Eden-NET User Guide (2017)) at 10 and 11.

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U.S. PATENT APP. NO. 11,445,328 – CLAIM 1

Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 24.